JiveX®
Enterprise PACS Solutions

JiveX DICOM Viewer
User Manual

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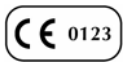

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JiveX® has Section 510(k) clearance under the following number: K053183

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Intended Purpose:

JiveX is a software system for managing, archiving, post-processing and reading as well as distributing of medical data which is available as DICOM data.

This product includes software developed by L2FProd.com (http://www.L2FProd.com/).

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1 Introduction

JiveX DICOM Viewer is an application for the visualization and processing of images, based on the latest Java technologies and developed especially for physicians. DICOM files can be opened and edited directly from a storage medium (e.g. a hard disk, a network directory or a CD-ROM).

Files with the file suffix *.dcm*, *.dc*, *.dicom* and *.dicomzip* are recognized as DICOM files. JiveX DICOM Viewer automatically starts and displays such images with a simple double click. Various standardized processing functions assure flexible image manipulations, e. g. grayscale windowing, various zooming functions and the Cine-function for animation.

Additionally, the JiveX DICOM Viewer provides a special functionality to display two image series in compare mode. This parallel display of images in their own display area makes the comparison a lot easier. JiveX DICOM Viewer can also perform a software calibration for normal color monitors in order to display monochrome images in calibrated form in accordance with the DICOM standard.

Like all JiveX systems, the JiveX DICOM Viewer is implemented in 100% pure Java to guarantee maximal platform independence. Therefore it is available with the same user interface and functionality on almost all operating systems.

JiveX DICOM Viewer is also available as a free Personal Edition for non-commercial use. This version is, however, limited in its functions and can only be used for a limited period of time. The Personal Edition can be downloaded from the VISUS website http://www.visus.com/.

You are not allowed to use the software for diagnosis or patient treatment!

2 System requirements

As a prerequisite for the proper operation and for an effective work with JiveX DICOM Viewer, a current computer with a current processor, sufficient RAM and hard disk space is required according to current market developments. With the JiveX DICOM Viewer installation, a current Java Virtual Machine is set up on the system.

3 Setup

The JiveX *DICOM Viewer* is an application developed with Java for displaying and viewing of DICOM files. Using the viewer, it is possible to load and display DICOM files from a directory or from removable media, like CD, DVD, USB stick etc.

The JiveX DICOM Viewer can be used on the most popular operating system environments. Together with the application program, a current version of the Java™ virtual machine is delivered. The installation program of the JiveX DICOM Viewer independently verifies whether the required Java™ version is available on the target machine and, if necessary, installs it.

Additionally, system variables are used to connect the JiveX *DICOM Viewer* with the Mime-Type "*application/dicom*". As a result, files with the extensions ".dcm", ".dc", ".dicom", ".jil" and ".dicomzip" can directly be opened with JiveX *DICOM Viewer*.

3.1 Installation on Windows Operating Systems

Please note:

For installing the JiveX DICOM Viewer on a Windows 7 operating system it is necessary to switch off the UAC (User Account Control). For this, please open the system configuration by running MSConfig (Run dialog in Windows). Then change the UAC settings in the tools tab by sliding the slider all the way down. Now, run the installation file of the JiveX DICOM Viewer by double-clicking.

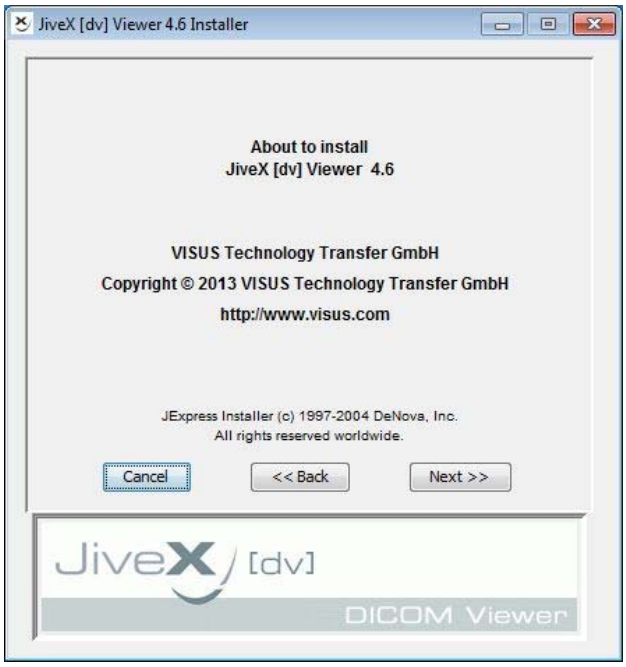


Fig. 1: Installation dialog of the JiveX DICOM Viewer

After running the installation file, an installation dialog is presented (see Fig. above). Using the "Cancel" button stops the installation process; to complete the installation, please click on the "Next" button. Then, a dialog comes up asking you to accept the VISUS license terms in order to be able to continue the installation process.

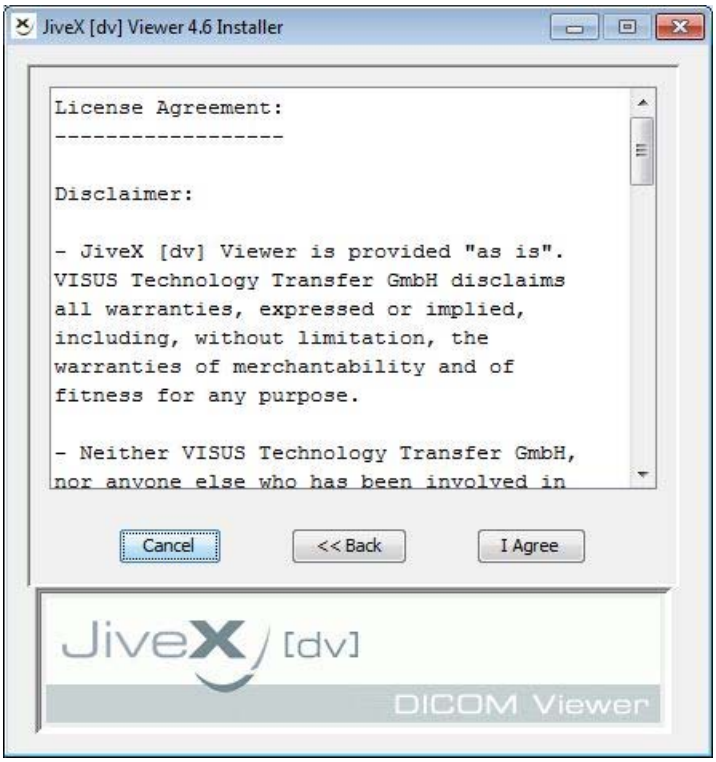


Fig. 2: License agreement dialog

Having accepted the license agreement, you can select an installation directory in the upcoming dialog.

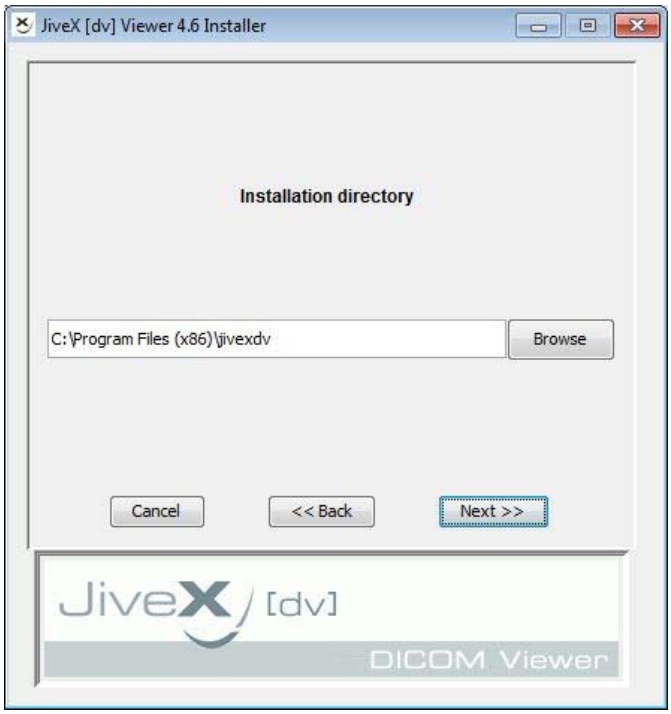


Fig. 3: Installation directory dialog

By default, the program suggests to install in the Windows program directory. We recommend using this setting. In case, you want to use a different installation directory, please use the "Search" button for your selection and confirm your choice by clicking the "Next" button. The JiveX DICOM Viewer installation is now being started. In the subsequent dialog that appears, you can complete the installation by pressing the "End" button.

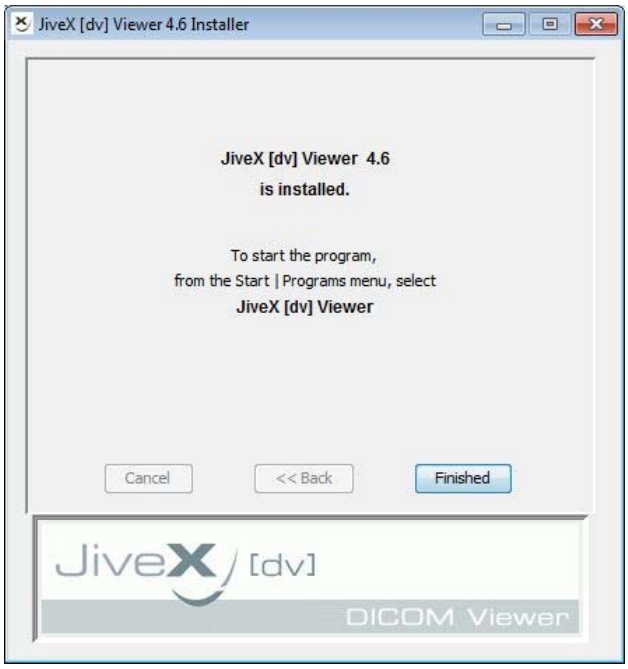


Fig. 4: Installation complete dialog

The user interface provides a menu bar at the top, a toolbar on the right side and one or more viewing sections in the center. The function panel (toolbar) makes available the most important functions for image processing.

Each viewing section offers a clearly arranged display of a certain number of images (e. g. a series of images). It consists of a pictorial index, a navigation panel and a viewport. At the bottom of the user interface there is a status bar. The pictorial index contains all loaded images of a viewing section in a miniaturized form (thumbnails). The navigation panel contains functions for navigating within the viewing section. The status bar shows information about the current display.

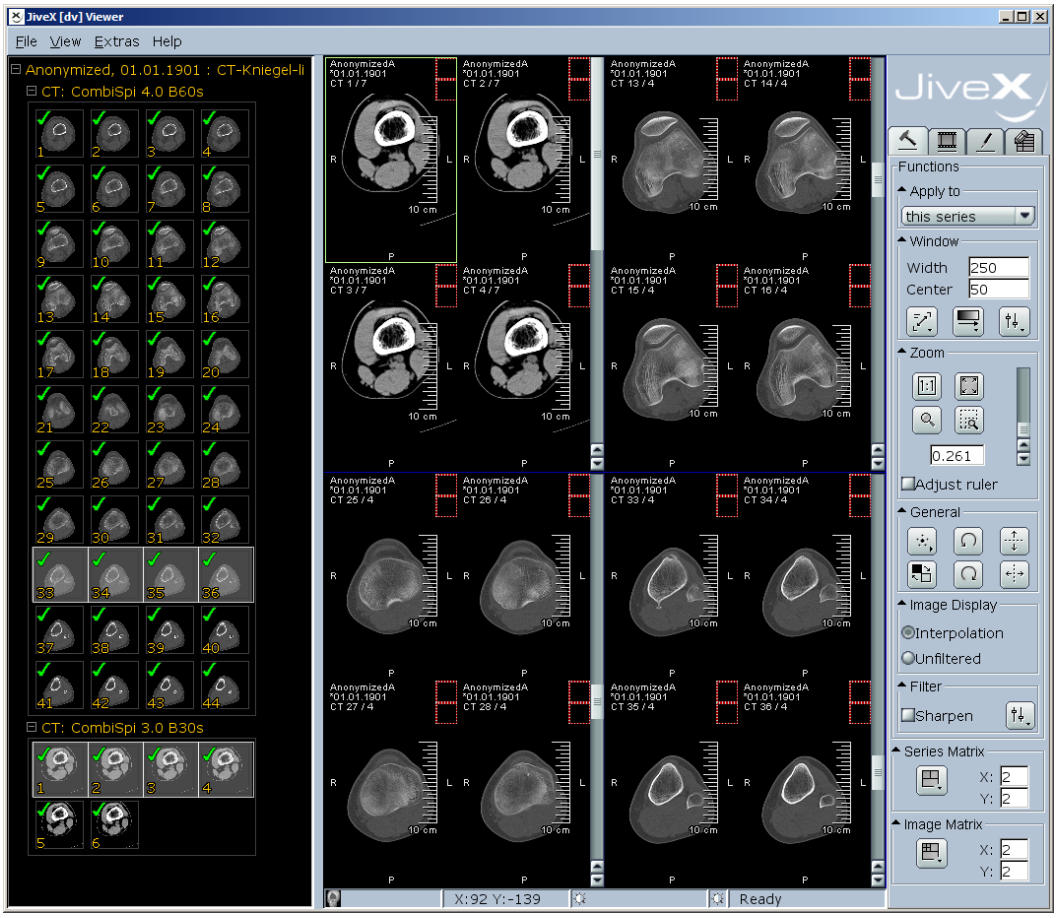


Fig. 1: JiveX DICOM Viewer with four image viewers, each showing four viewing sections

5 Menu Bar

The menu bar provides general functions, such as loading images from the file system. In addition, it regulates certain program settings (e. g. the selection of a language).

5.1 "File" Menu

The "File" menu contains the following functions:

- **Open**
  If JiveX DICOM Viewer is set to Single Mode, you can select one (or several) images, or alternatively choose a directory. From the "File" menu, please choose the "Open" item by using the left mouse button. A dialog box opens (Fig. 2) to select single images as well as directories from. When selecting a directory, all images contained are loaded and displayed. Any existing sub-directories are ignored.

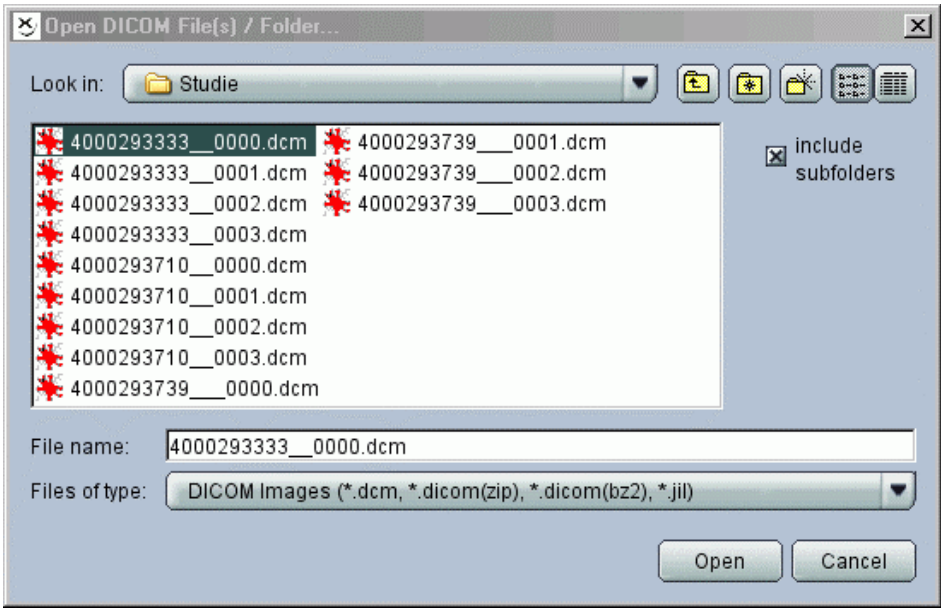


Fig. 2: "Open File" Dialog

- **Open Presentation State**
  This menu item opens a DICOM Presentation State. If a loaded Presentation State refers to loaded images, they are applied to them. If more than one Presentation State is loaded, these can be managed (enable, disable etc.) via the function

panel ("Presentation State" tab).

- **Save Presentation State**
  This menu item saves a DICOM Presentation State for loaded images including their manipulations, like, e.g. windowing, displayed areas, drawn annotations.
  Please note: This function is only available in the full version.

- **Export**
  This function enables you to convert displayed images into the graphic formats JPEG, BMP, PNG and PNM and to store them in the local file system. JPEG and PNG can easily be inserted into a web site and displayed afterwards.
  The following settings are provided by the export dialog:
  - You can either export the DICOM image in its original size and with the just-applied windowing, or just the visible part of the selected viewing section with all the associated annotations.
  - You can resize the image to be exported.
  - For exporting in a JPEG format, you can choose between three different image quality levels.

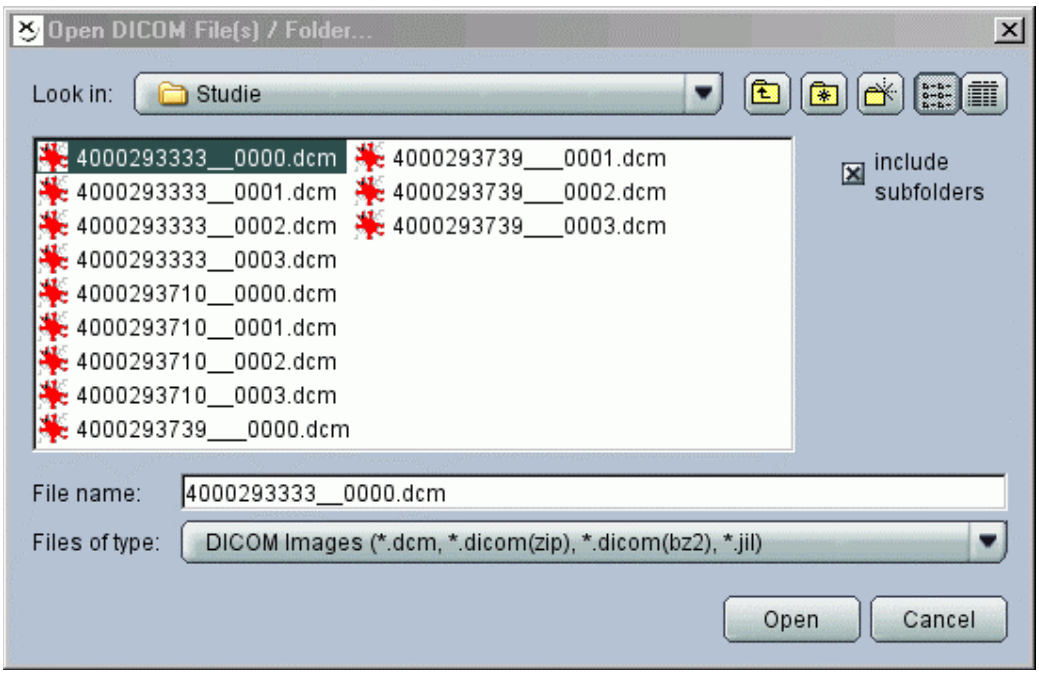


Fig. 3: "Export" Dialog

When exporting a matrix or series, the image number is automatically appended to the file name. If e.g. a series of 42 images is exported in JPEG format using the filename "TestSeries", files will be generated named from "TestSeries_0001.jpg" to "TestSeries_0042.jpg".

While the export is processed, a progress bar indicates the export status.

Please note: The Export function is only available in the full version.

- **Print**
  This menu item prints the selected image, matrix or the complete series on a laser printer or paper printer.

- **Quit**
  With this menu item, the JiveX DICOM Viewer is terminated.

5.2 "View" Menu

The "View" menu provides the following functions:

- **Reset**
  This function sets back the JiveX DICOM Viewer to the status at start of program.

- **Swap Viewer**
  This feature allows you to switch between standard and comparison mode.

- **Language**
  This feature gives you the choice of selecting one of several languages. It is possible to switch frequently between the available languages.

- **Full screen**
  This function hides the title bar.

- **DICOM Info**
  A DICOM image contains the image information in addition to other attributes, such as the patient's demographics. Selecting this menu item, all the attributes contained in an image can be displayed.

5.3 "Extras" Menu

The "Extras" menu provides the following item:

- **Load DICOM Dump**
  This function displays all DICOM information of any DICOM file (see DICOM Info).
  Please note: This menu item is only available in the full version.

5.4 Menu "Help"

The "Help" menu provides the following items:

- **Import license key**

Via a file dialog you can open the VISUS license key file (*.vlk). Then the blocked features of the demo version will be activated.

- **Manual**
  The JiveX DICOM Viewer Manual is opened with the Adobe Acrobat Reader.

- **About**
  The "About" dialog provides product and system information.

6 Viewing Section

A viewing section is a clearly arranged display of a certain number of images (e.g. a series of images). It consists of a pictorial index, a navigation panel and a status bar (Fig. 4). Additionally, there are viewports which display either a single image or a matrix of images (see section "Altering the image matrix").

The pictorial index contains all loaded images as thumbnails. The status bar provides you with information about the current display. JiveX can display simultaneously several viewing sections. Thus you can easily compare series or images.

Fig. 4: Viewing Section

The active viewport is marked with a green frame. You can select a viewport by simply clicking on it. If a viewport displays a matrix of images, the selected image has a cyan frame. There can only be one selected viewport or matrix element at a time.

6.1 Pictorial index

The Pictorial index displays a miniaturized overview of every image loaded in the viewing section (Fig. 5). These miniaturized images are ordered by image number derived from their DICOM information. The studies of a patient are sorted by the study date with the newest study on top. By loading studies of more than one patient, the patients are separated with its studies sorted by date.

If such a miniaturized image is clicked on with the left mouse button, it is displayed in a previously selected viewport. This viewport is then marked with a green frame.

When you click the left mouse button on such a thumbnail, the image with subsequent images are also displayed, provided the viewport shows a matrix. Otherwise, only the clicked image is displayed (see section "Changing the Image matrix").

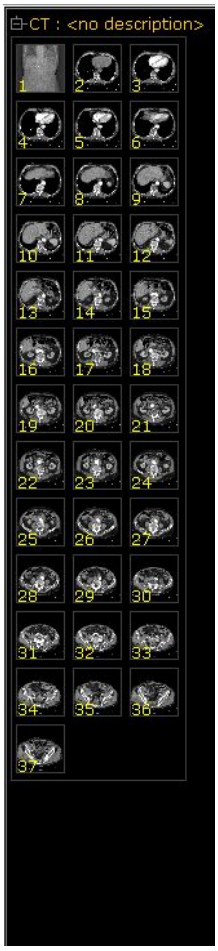


Fig. 5: Pictorial index

When the mouse pointer moves over a certain image of a viewport, the corresponding image in the pictorial index is marked with a white frame (Fig. 5).

Also, you can drag and drop images from the pictorial index into the image viewport with a pressed mouse button. If a viewing section is linked to other viewing sections, the link state will be kept (you can disable this behavior in the Review Client).

When holding the [CRTL] key and performing a drag&drop action on an image which is then released over a matrix, the released image is inserted to the position of the previous image, given that both images belong to the same series.

A right mouse click on the pictorial index brings up a context menu which allows toggling the current series sort order or removing the series or the complete study from the viewer.

Please note that the following information only applies to the Review Client, Diagnostic Client and Demonstration Client:

The pictorial index can show green check markers within a thumbnail image. This indicates that a series including its pixel data is completely loaded due to an activated new and "optimized loading mechanism" (Fig. 6: Pictorial index with green checked series).

If the green check markers are missing, only image information is loaded and pixel data is requested later on demand.

Fig. 6: Pictorial index with green checked series

With an activated "Multi Site Query" function, for each study the name of the remote server is displayed in italics in the pictorial index and in the Mouse-over pop-up window of a study (Fig. 7).

If the "Multi Site Query" function is not activated, or if the study is on the selected server, the server will not be indicated.

In applying the "Multi Site Query" function, unavailable image types (like DCMPRE) will not be regenerated during image loading.

The DCMPRE files must already be stored on the remote server, so that this function can be used.

Fig. 7: With an activated *Multi Site Query* function, the name of the server is indicated from which the study was requested

6.1.1 Labelling of prior studies displayed in the thumbnail bar

When a study is loaded with appropriate prior studies, the image information of prior studies will be displayed in italics, given that the main study includes newer image data created by the same modality. Here, the study date is taken as a criterion for comparison (Fig. 5).

If, for example, the prior and main study include each a series created by the "CT" modality, then the prior study will be displayed with italicized image information which makes it easy to identify.

If, however, the main study only includes series created by the "MR" modality, then the image information of the prior CT series will not be displayed in italics.

This functionality is disabled by default. However, it can be switched on via the menu item "View -> Image Information" or via context menu.

If requested, the current configuration is saved in the user profile when you exit the viewer.

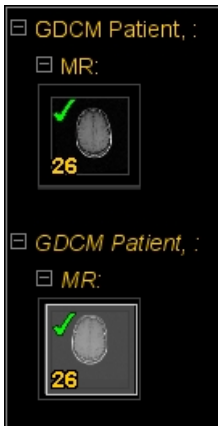


Fig. 8: Labelling of a prior study with image information given in italics

6.2 The Viewport

The viewport displays images. While moving the mouse pointer over an image, the corresponding thumbnail in the pictorial index is marked with a gray frame.

The upper red box in the top right corner allows locking an image (see section "Locking Image"). Locked images cannot be manipulated and are excluded from all following operations. This is of particular interest if you want to use the "Series" application mode in which image manipulations are applied to all images displayed in the viewing section, except for the locked ones (see section "Application Mode").

Additionally, the JiveX Review Client and the JiveX DICOM Viewer Light provide a second red box which allows marking images as key images.

The lower red box can be used to chain-link series. When chaining two or more series, these can be panned, zoomed, flipped or rotated and navigated simultaneously. However, the 'Windowing' function is excluded from this chain-linking option.

Patient information can be displayed in the viewport's top left corner (see section "Navigation Panel"). In the middle of the right border a ruler can be displayed and orientation letters can be shown on the left and right hand side. Additionally, the consecutive image number of each series image can be displayed.

Clicking the right mouse button on the viewport only opens a context menu if you have not clicked on the brink of an annotation. This menu allows the following operations:

- Display one of the loaded series within the viewing section. If studies are loaded, series are displayed in a submenu.
- Mouse action:

  The action for the left mouse button can be toggled (pan, window, zoom or navigate).

- Image information:

  Viewer specific annotations such as patient information, a ruler, orientation letters, JiveX image number, Window Level Zoom and user defined DICOM tags can be switched on or off.

  Patient studies previously created by the same modality, can be marked as previous studies by using italic font displayed in the viewing section and the thumbnail bar. This marking can be switched on or off.
- Paste / Paste to all images:

  A copied annotation can be pasted to the current image or to all images of the current series.
- Scanline icom / View Cutlines / View Locator:

  Change the scout icon or show cutlines or a locator image.
- Copy to clipboard
- Export:

  Export the current image / matrix / series as JPEG, BMP, PNG, TIFF or PNM.
- Print:

  Print the current image / matrix / series. The bottommost menu item will switch the compare mode on or off depending on the current mode.
- Series Matrix:

  Selection of the series matrix (Compare mode=2x1, Single series mode=1x1, predefined matrices).
- Original Size:

  Zoom to original size or to maximize the images in their viewports.
- Sort ascending / Sort descending:

  Reverse series sort order.
- Restricted sync. scrolling:

  Synchronous scrolling according to image position and orientation.
- Split series:

  Splitting series is only available for CT and MR series.
- Windowing:

  Choose a predefined window setting.

6.3 Scouts and Scanlines

For better orientation within a slice stack, a scout (overview image) with scanlines can be displayed within the image viewport, provided that the series has such a scout.

Initially, the scout image must be displayed in the image viewport. To set the displayed image as scout, please select the context menu item *Scanline icon*, *View as Scout*.

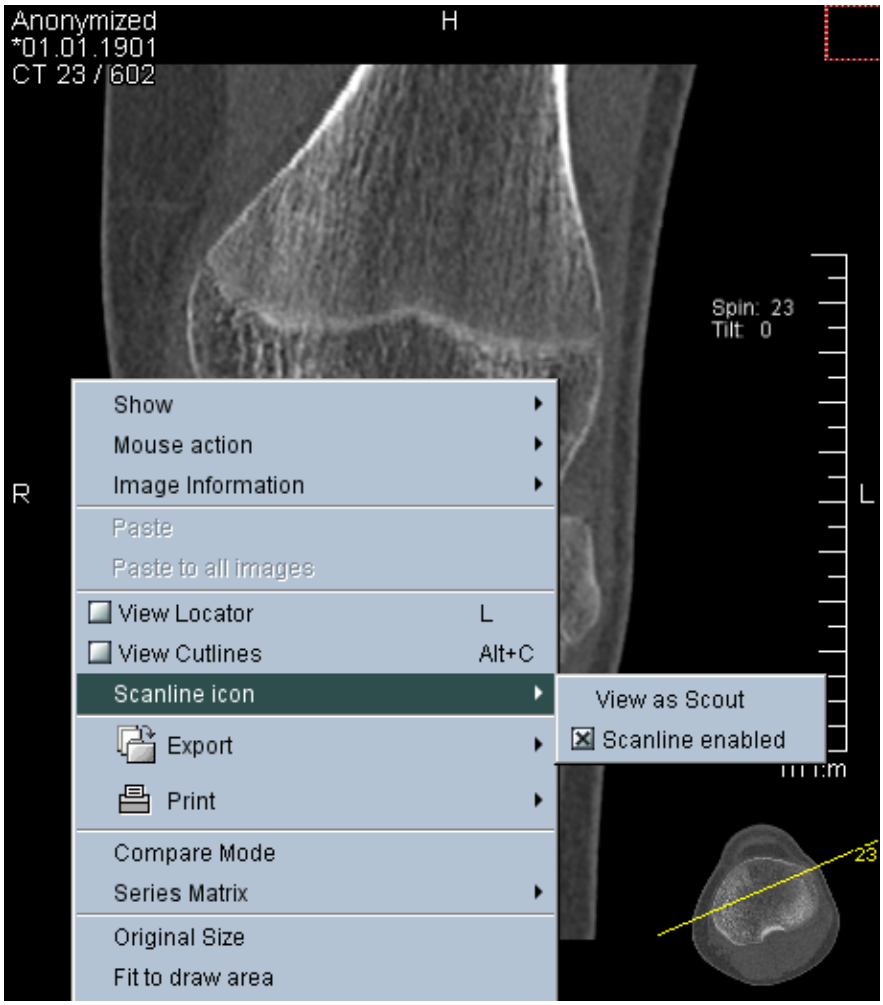


Fig. 9: Context menu

The scout is then displayed in the bottom right hand corner of each image viewport and serves as reference image for the examined area. A series matching the scout image can be added to the image viewport. Within the scout, the position of the currently displayed image slice is marked with a yellow scanline.

The scout view can be disabled or enabled by selecting the appropriate menu item from the context menu (*Scanline icon*, *Scanline enabled*).

6.3.1 Scanline Display Accuracy

To show a meaningful scanline, the scout image plane and the displayed image plane should preferably be right angled to each other. By default, if the angle between the scout image and the displayed image is less than 40 degrees, i.e. the images are almost perpendicular to each other, then the scanline will be hidden.

Optionally, scanlines can be configured to be displayed for smaller enclosed angles. For cutting angles which are smaller than 15 degrees, i.e. nearly parallel images, the calculation of the scanline position will be numerically inaccurate. Therefore, in this case, the scanline is dashed. In addition, a yellow warning triangle is displayed in the upper right hand corner of the scout image.

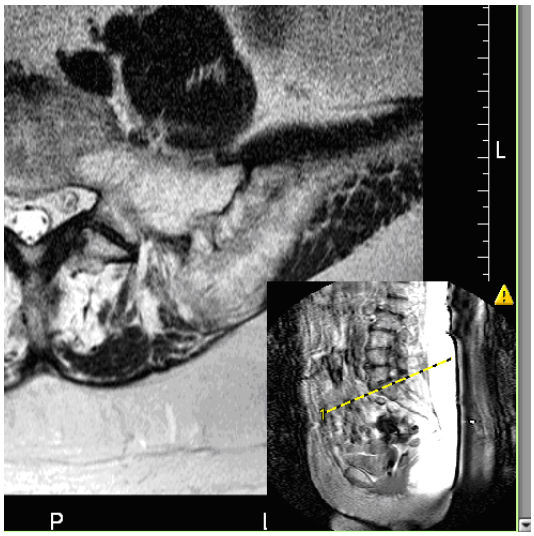


Fig. 10: Warning symbol indicating inaccurate scanline position

6.4 View Cutlines

For better orientation, cutlines can be activated via the context menu. This feature is especially helpful for a simultaneous view of multiple series as the cutline of the selected image is displayed in each image together with the image number of the selected image (if possible).

Since the cutline for intersecting, but almost parallel image planes has a small explanatory significance, it will disappear when the intersection angle of the image planes is less than 40 degrees.

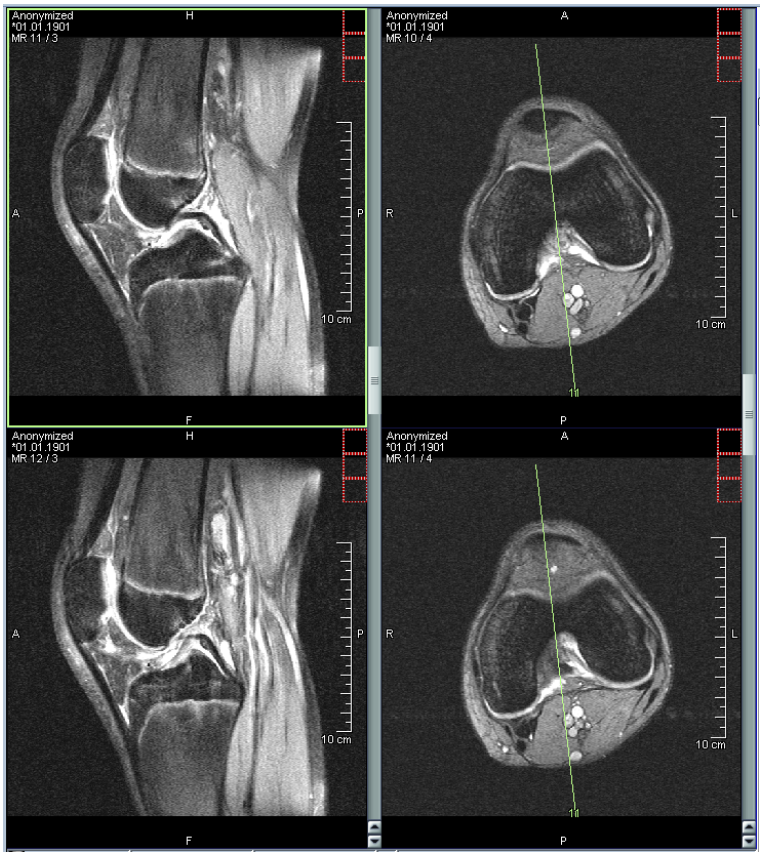


Fig. 11: Cutlines

6.5 Series Position Synchronization

In slice stacks (e.g. MRI or CT series) it is possible to display each series synchronized by position in patient coordinate system.

If you hold the button [3] while at the same time moving the mouse cursor, slices are synchronized according to the mouse cursor position.

Automatically, corresponding images in other layers will be displayed. The green line indicates the cutline of the image in which the mouse cursor is positioned. The green crosshair indicates the position of the patient's coordinate under the mouse cursor in other images.

If the mouse position is outside of a slice stack volume, then the crosshair disappears and a notice is displayed in the image viewport.

Abb. 1: Synchronized image series

For this kind of synchronization it is essential that each image includes information about image position, image orientation, and pixel spacing.

6.5.1 Slice Position and Orientation Alignment

By pressing the [Q] key other series are aligned to the slice position of the currently focused series. This will show the same anatomical region to enable direct image comparison. However, only those series are aligned, which have a similar orientation of the image plane.

Thus, for example when you press [Q] is an axial slice, only those series showing also axial slices are aligned. The orientation is considered similar if the image planes are at an angle of less than 15 degrees to each other.

When aligning oblique MPR series of similar orientation, the orientation will be aligned in addition the slice position. This will result in a most similar representation. VRT series of similar orientation are aligned only in orientation, as a slice position does not exist here.

The shortcut [Shift] + [Q] is similar to the function of [Q], however the alignment of Oblique MPR and VRT series always takes place, regardless of the similarity of orientation.

6.6 Status Bar

The status bar provides useful information: On the left hand side, the up-to-date progress of image loading is shown.

In the next field, the mouse cursor coordinates in the image are displayed (depending on the current zoom and panning of the image).

Next, the pixel value of the current mouse cursor position follows. For CT images this is indicated in Hounsfield units and brightness value (for gray value images only).

The icon to the right shows the current action of the left mouse button on the image (panning, windowing, and image navigation). The text itself contains information about the current function.

While processing gray level windowing, the status bar contains the appropriate values for window center and window width.

The currently used Hanging Protocol is displayed on the far right.

Fig. 12: Status Bar

6.7 Compare Mode

The "Compare Mode" of JiveX DICOM Viewer allows the parallel display of image series, each in a separate viewing section. Via the function panel you can choose a series matrix to layout your series. Within a viewing section you can also choose an arbitrary image matrix.

7 The Viewing Section Toolbar

The viewing section toolbar is right of the image display and is organized in tabbed panels which provide various controlling and image manipulation functions (Fig. 13). After a tab is selected, its color is lightened.

Grayscale windowing is only one example of the functions contained in the "General Functions" tab panel.

Opening the tab panel "Cine" allows you to perform a film-like display of all images of a viewing section (Cine-loop).

The tab panel "Annotations" provides features to create and manipulate graphical and textual annotations.

The different functions are organized in function groups. Each group has its own frame with a small clickable triangle in the upper left corner.

If this triangle is clicked with the left mouse button, it opens or closes a function group (Fig. 13: Viewing Section Toolbar).

If the triangle points up, the function group is open and provides a range of features to use.

If the triangle points down, the function group is closed making it impossible to select a function from within this group.

Fig. 13: Viewing Section Toolbar

7.1 Processing Functions

The range of available functions displayed within the function panel, depends on the used Client (e.g. Review Client or Diagnostic Client):

While the JiveX Review Client provides a basic set of features (General functions, Cine-Mode, Annotations, Presentation States, Key Image Administration),

the JiveX Diagnostic Client provides additional features like ECG, RT Administration, MIP/MPR Reconstructions.

7.2 General Functions

7.2.1 Application Mode

The application mode defines whether image manipulations, e.g. grayscale windowing or zoom, are applied to single images or to complete series.

Fig. 14: "Apply to" Function Group

The following application modes are available:

- **Image**
  Manipulations are applied to the image previously selected. The selected image is marked with a green frame.

- **Series**
  Manipulations are applied to all images of a series except the locked ones. In "Compare Mode", manipulations are applied only to the series of the currently selected viewing section.

Please remember that geometric and textual annotations (see chapter "Image Annotations"), Calculations (see chapter "Calculation Functions") and Shutters (see chapter "Shutters") are always applied to the actual image. In this case, the selected application mode will be ignored.

7.2.2 Image Locking

For locking an image, each viewport has a small red box in the upper right corner (Fig. 15). This box can be activated and deactivated with a mouse click.

If an image is locked (marked with a yellow lock symbol), it will be excluded from all manipulations applied hereafter until the lock is deactivated.

Fig. 15: Activated lock

7.2.3 Selecting an Image

An image is selected by clicking into the viewport which displays the image. The viewport is then marked with a green frame. In the pictorial index the corresponding image is marked with a fine white frame (Fig. 16).

While moving the cursor over an image in the viewport, the corresponding image in the pictorial index gets framed with a thicker white line.

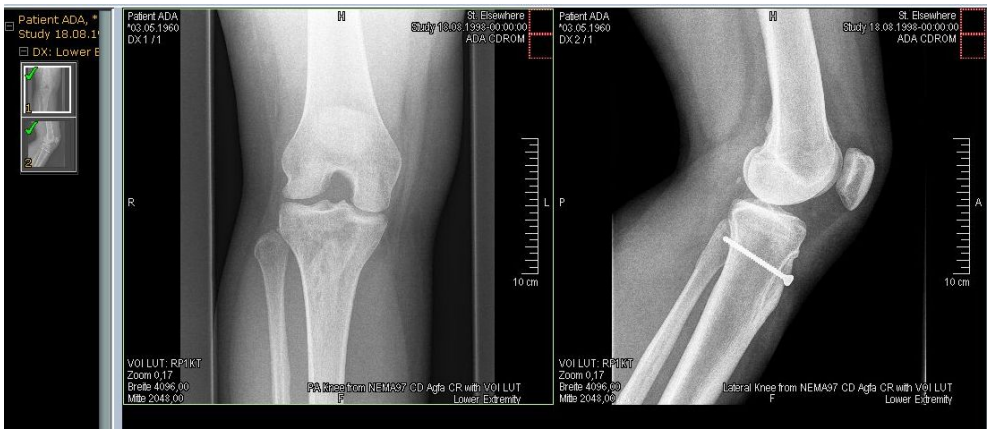


Fig. 16: First image is selected in Viewport

7.2.4 Windowing

JiveX provides various options for using the windowing function. The easiest way is to use the left mouse button. By keeping it pressed and, at the same time, moving the mouse vertically, the grayscale window's center can be changed. By moving the mouse horizontally, the grayscale window's width is altered. The corresponding values are displayed in the status panel.

For color images, the windowing corresponds to a brightness / contrast adjustment.

The viewing section toolbar also supplies you with a function group for windowing (Fig. 17).

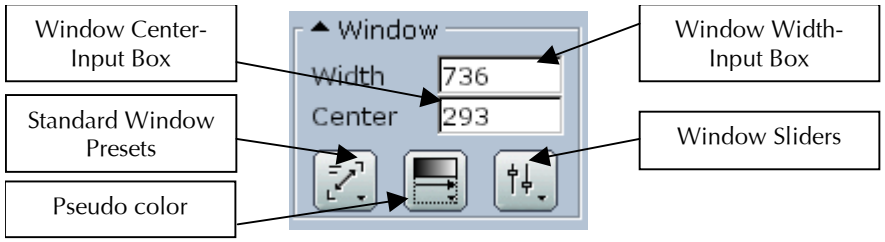


Fig. 17: Function Group "Grayscale Windowing"

The desired window width and center can be entered into the two input boxes.

After confirming the entry by pressing the return key, new values are applied to the display. Predefined sets can be selected by clicking on the button "Standard Window Presets".

Standard Window Presets

A mouse click on the "Standard Window Presets" button opens a context menu as shown in the figure below:

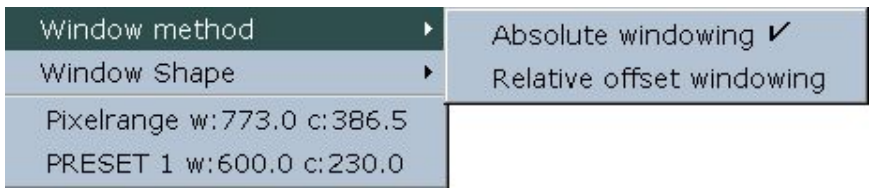


Fig. 18: Context menu "Standard Window Presets"

In the lower area (below the line) of the context menu, pre-defined window settings can be selected via a mouse click and applied directly to the images.

In the upper range of the context menu, the "Window method" and "Window shape" can be chosen:

Window method

There are three ways to perform the windowing:

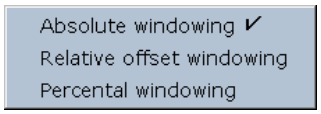


Fig. 19: Context menu "Window method"

- **Absolute windowing**
  The option "Absolute windowing" applies the set window value (set via mouse click or entering fields) to all images in a series.
- **Relative offset windowing**
  By this setting, a percentage change of the window values is calculated relative to the entire gray scale value and applied to all images of the series. This is helpful, when MRI scans within a series were taken with differing window values. For CT examinations, this function is not available (the choice is grayed out or disabled).

  If this option is selected, the windowing is first changed via the mouse or the input fields. Then the relative offset windowing is applied to all images in the series.
- **Percental windowing**
  This window method is only available for nuclear medicine image data (modalities NM, PT, and ST) and is the default setting for this type of image data. Windowing changes made for one image are applied to other images of the series by setting the current percentage values for the upper and lower window value for all images in the series.

Window shape

There are four forms of windowing, which can be selected via mouse click:

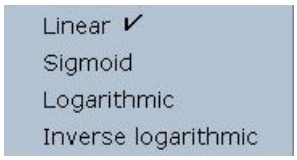


Fig. 20: Context menu "Window shape"

- **Linear windowing**

  The window shape "Linear" selects a linear windowing. This is the default for most image data.

  The window values are mapped along a linear ramp; the values increase uniformly.

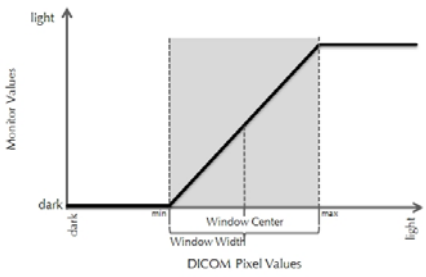


Fig. 21: Window shape "Linear"

- **Sigmoid windowing**

  The sigmoid function has the effect that gray values from the middle range of a window are highlighted stronger than gray values in the outer regions of a window. The contrast is increased in the central part of the gray scale window.

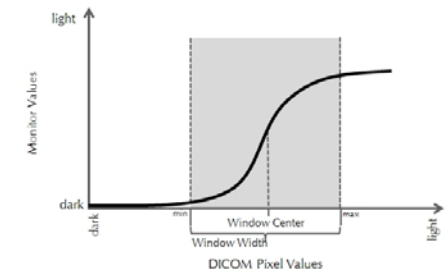


Fig. 22: Window shape "Sigmoid"

- **Logarithmic windowing**
  With the logarithmic windowing function, all pixel values in the dark gray scale area will be emphasized. The contrast in darker gray values is higher.

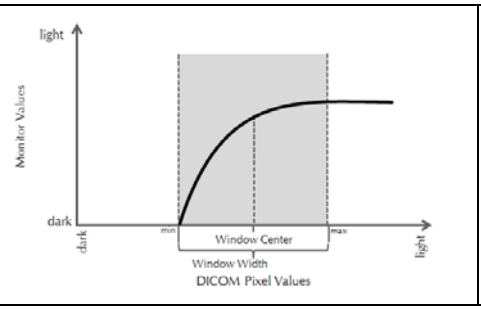


Fig. 23: Window shape "Logarithmic"

- **Inverse logarithmic windowing**
  With the inverse logarithmic windowing function, all pixel values in the bright gray scale area will be emphasized. The contrast in bright gray values is higher.

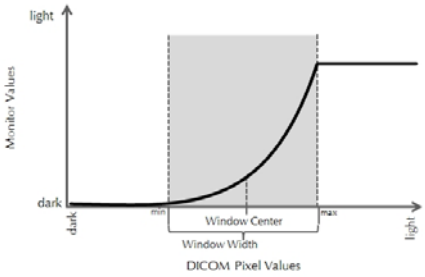


Fig. 24: Window shape "Inverse logarithmic"

Window Sliders

Windowing can also be altered with the window slider when the corresponding button is clicked (Fig. 25).

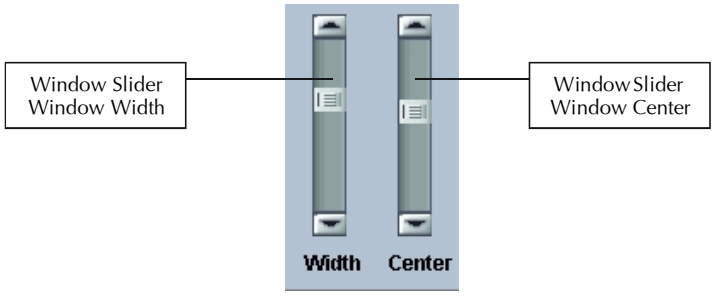


Fig. 25: Grayscale Window Sliders

Also you can access the window presets via context menu of the images:

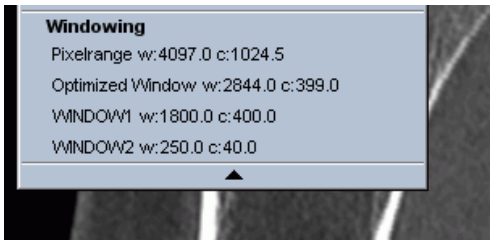


Fig. 26: Context menu with window presets

Windowing for nuclear medicine images

For nuclear medicine image series (modalities NM, PT, and ST), the window will be displayed in the image information overlay as "Upper" and "Lower" window level instead of "Width" and "Center" window level.

Following the gray level indications, the share of the image gray scale is given in percent and appears in parentheses.

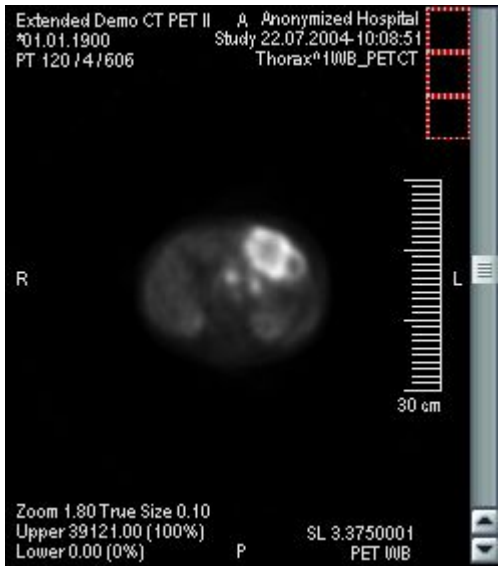


Fig. 27: Upper und lower window levels and percentage

Nuclear medicine images automatically contain computed percentage window presets. The standard windows are defined in steps of 10%, covering a range of values from 10% to 100%, based on the gray level amount.

The standard windows can be selected with the window presets in the function panel. Alternatively they can be traversed with the shortcut [**b**].

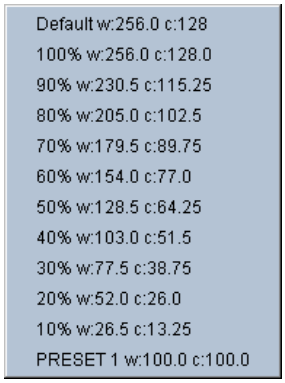


Fig. 28: Percentage window presets

After clicking the "pseudo color" selection button, the following window opens:

Fig. 29: Pseudo color selection

Having applied the normal window settings and a pseudo color, the selected image or series (depending on the "Apply to" selection) appears in pseudo color applying the normal window settings.

7.2.5 Zoom Functions

Another function group within the viewing section toolbar provides further options for altering the image size. These options are as follows:

- An absolute magnification factor can be entered into the input box.
- Images can dynamically be zoomed in or out by using the slider.
- The icon "1:1" displays the image in its original size, i.e. one pixel of the DICOM image corresponds to one pixel on the monitor.
- JiveX can auto-calculate the image size in order to optimize its fit in the viewport. To do so click on the icon "Fit to Viewport".

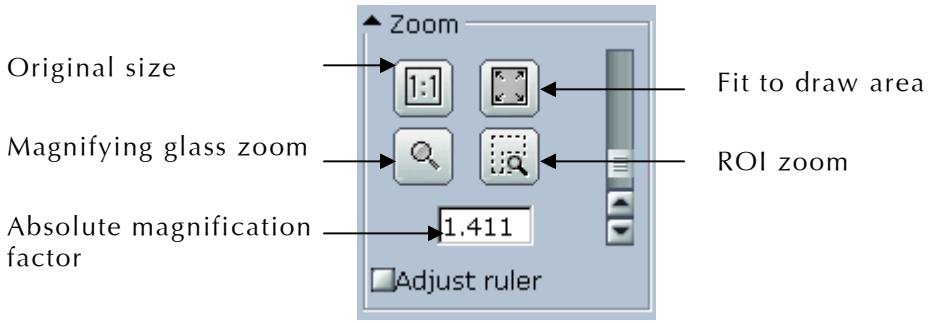


Fig. 30: "Zoom" Function Group

By clicking on the icon ROI Zoom (**R**egion **O**f **I**nterest) (Fig. 30: "Zoom" Function Group), any area of the image can be selected and scaled up using the mouse.

First, activate the icon "ROI Zoom" with a mouse click. Then position the mouse pointer on the image and select/mark the desired area; keep the left mouse button pressed while moving the mouse. A yellow rectangle appears which marks the selected area. As soon as you release the mouse button, the selected image area is adapted to the current viewport size and displayed in maximal zoom. To change the zoom factor press the [Z] - key whilst dragging the image into the viewport with the mouse.

With the "Adjust ruler" - checkbox you can adjust the rulers of all visible images, so that all images are scaled equally. If one of the images is then zoomed in/out, all images are adjusted accordingly in this particular size. Please note that images without given pixel sizes are excluded from this ruler adjustment.

7.2.6 Image Display

For images displayed inside the viewer, there is an option to choose between two different types of display methods. These can be applied to either a single image or to series. The two display options are as follows:

- *Interpolation* - When zooming, missing pixel values are interpolated from adjacent pixels. This results in a 'smoother' image impression.
- *Unfiltered* - When zooming, missing pixel values are replicated from adjacent pixels.

Fig. 31: "Image Display" Function Group

7.2.7 Filter

Images can be filtered by using an operation called "Sharpen" which can be found within the "Filter" function group.

The Mammography Client additionally provides the CLAHE filter (CLAHE - contrast limited adaptive histogram equalization). These filter types are applied either to series or single images inside the viewer:

- *Sharpen* - Edges within images are emphasized. Major differences in brightness are called edges. The sharpening gives a 'sharper' image impression.
- *CLAHE* - The contrast is enhanced while local conditions of an image area are respected.

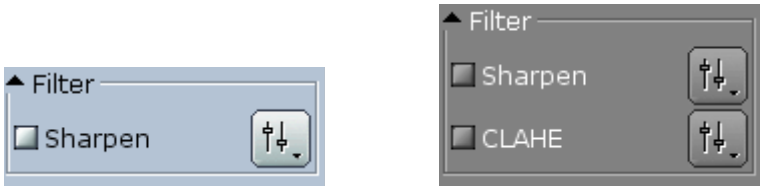


Fig. 32: "Filter" Function Group; Mammography Client to the right

At first, please choose an image area with image structures whose edges are to be highlighted. Then zoom closely into this image area.

Press the button right next to the *Sharpen* key to show the sharpen sliders (Fig. 32: "Filter" Function Group; Mammography Client to the right). The parameters of sharpening can be controlled (Fig. 33: Sharpen Sliders). The effect of the settings can be immediately assessed on the zoomed image area.

Once the sharpen sliders are modified, the sharpening function will be automatically switched on.

The sharpen slider "Radius" adjusts the sharpening radius which is indicated in pixel.

With a small radius, only very small structures with steep edges are highlighted; with a larger radius, bigger structures with shallow edges will also be highlighted.

The larger the selected radius is, the wider becomes the surrounding of contrast amplification arising at the edges. If a radius is too large, it causes a so called "halo artifact" near the edges. Therefore, the radius should be adjusted as small as possible so that the desired structure is still highlighted.

The sharpen slider "Amount" adjusts the strength of sharpening, i.e. the magnitude with which edges within the image are highlighted.

A small value of the amount of sharpening causes only a minimal change while larger values produce strong highlighted edges.

To adjust optimal sharpening parameters, use an initially high "Amount" value, for example "0.8". Then slowly increase the "Radius" value, starting from a small account and running up until the desired structures are highlighted in the picture.

Finally, if necessary, reduce the sharpening "Amount" until the desired image impression is reached.

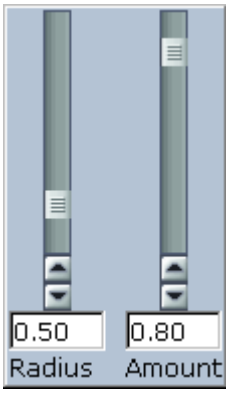


Fig. 33: Sharpen Sliders

If a particular image area needs a contrast enhancement, then please zoom into this area and press the button right next to the "CLAHE" option (see Fig. 32, on the right) to show the "CLAHE" intensity slider (see Fig. 34).

The intensity of "CLAHE" filtering can be controlled interactively so that the effects can immediately be assessed within the zoomed image area.

Once the intensity slider is modified the "CLAHE" filter will automatically be switched on.

When choosing a small intensity, the outcome of the contrast enhancement is minimal. By increasing the intensity, the contrast is raised stronger accordingly.

Fig. 34: CLAHE Intensity Slider

7.3 Magnifying Glass

The "magnifying glass" option allows to magnify sections of the underlying DICOM image - without loosing the orientation in the image. The magnifying glass can be moved over the image by using the mouse.

To move the selected area or to resize it, simply drag the mouse inside the "resize box" in the bottom right hand corner of the magnifying glass area.

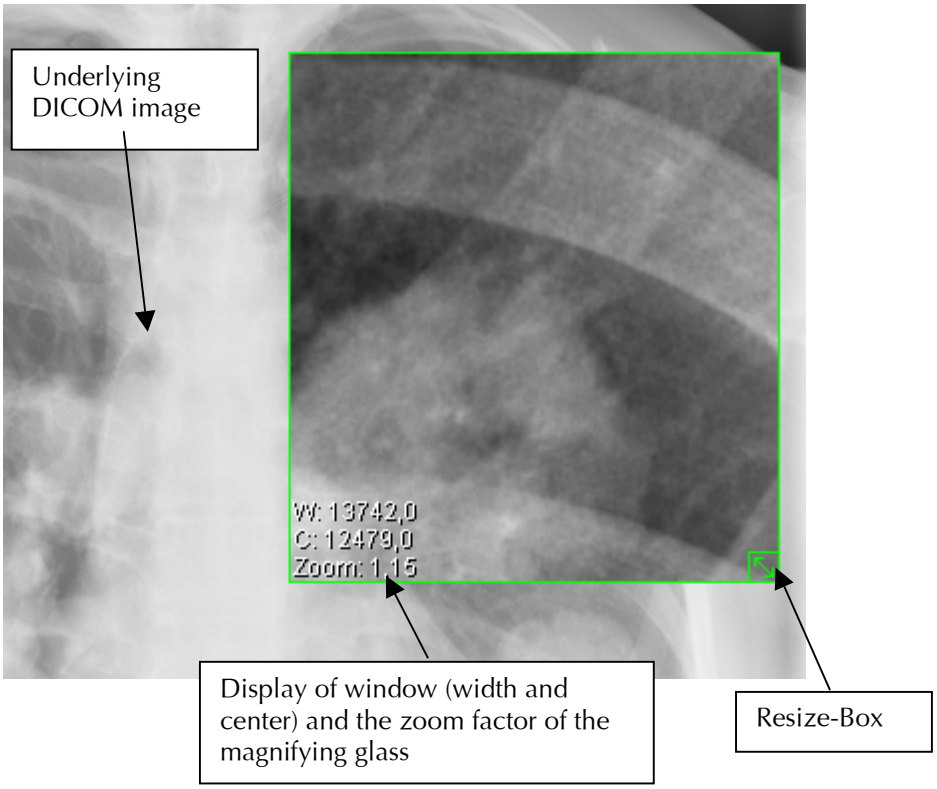


Fig. 35: Magnifying Glass

The window settings and the zoom factor of the magnifying glass also can be changed. For changing window settings (width and center), you may press the [W] key while moving the mouse with a pressed left mouse key.

To change the zoom factor you may press the [Z] key while moving the mouse with a pressed left mouse key. In both cases the mouse pointer must be positioned inside the magnifying glass area. The figure above illustrates the magnifying glass on a DICOM image with a different window setting and a greater zoom factor.

The magnifying glass can be activated either with the lens button inside the function panel or with a pressed [M] key while clicking on an image.

If the magnifying glass function is no longer wanted, simply click beside the lens window to close it.

7.3.1 Rotating / Flipping / Inverting / Reset

The viewing section toolbar provides tools for further manipulation of the image display (Fig. 36). Images can be reset, inverted, rotated in 90° steps (both anti-clockwise and clockwise) and flipped vertically as well as horizontally.

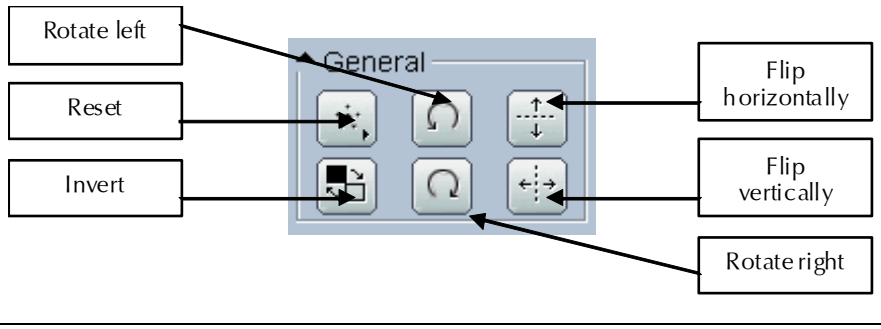


Fig. 36: "General" Function Group

7.3.2 Reset

With the Reset function you can reset a single image or a whole series to thet state when the image was loaded, depending on the setting "Functions apply to".

You can also specify in a popup window which facet of an image manipulation will be reset. To get to this popup window, hold the left mouse button on the reset button for a short time.

There you will see several rows with all the facets you can reset separately, like a window, a rotation or a pan. A hooked checkbox means this facet will reset when clicking on the reset button. The Review Client will save the selection of facets for the reset inside the user profile and restore it with the next login.

Right to the name of each facet you will find a small "reset" button to reset immediately a single facet of image manipulation. The tab panel will lead you to common facets or MPR/VRT specific facets.

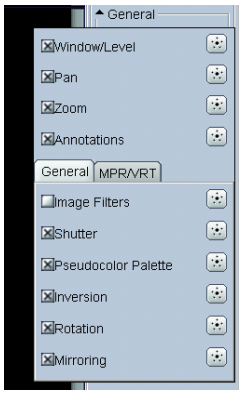


Fig. 37: Popup window of the Reset button

7.3.3 Image Orientation

If the displayed image contains orientation information, this information is displayed at the edges and in the middle, using a capital letter; it adapts to rotation and flip operations. The following letters are used:

A - Anterior
P - Posterior
L - Left
R - Right
H - Head
F - Foot

The context menu "Annotations" / "Image Orientation" shows or hides the letters.

7.3.4 Altering the Presentation Matrix

This function group alters either the series matrix to view multiple series or the image matrix for multiple images of one series (Fig. 38).

The number of rows and columns can be entered into the two input boxes of each matrix area. The input is confirmed by pressing the return key. By clicking on the icon "Image Matrix Presets" or "Series Matrix Presents" a predefined matrix like 1x1, 2x1, 1x2, 2x2, 2x3, 3x3 etc. can be selected.

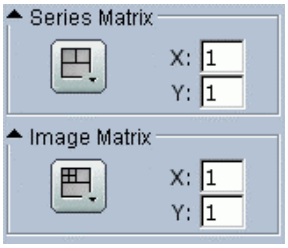


Fig. 38: "Matrix" Function Group

By double-clicking on the image, the selected image is opened in full screen mode.

With JiveX Review Client you can choose the matrix of the full screen mode via hanging protocols. The selected image is displayed in maximal zoom. Another double-click restores the previous matrix setting.

7.3.5 Panning

Images can be moved around within the viewport. To do so, please position the mouse within the viewport, select the "Mouse action" ►"Panning" via context menu and press and hold the left mouse button while moving it.

Alternatively, press the [P] key while dragging the image with the mouse. The mouse pointer turns into a hand. Release the mouse button to stop dragging the image.

You can also hold down the mouse wheel like a button and pan the image by moving the mouse.

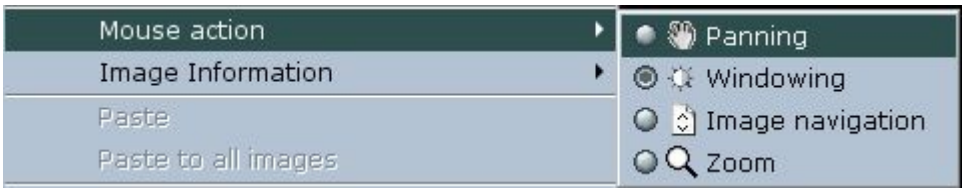


Abb. 2: Context menu for the Mouse action "Panning"

Additionally, the program contains a "Cine" function. All images loaded into a viewing section can be viewed like a movie. The playback speed of this application can be adjusted. It is possible to play either forwards or backwards. As soon as the last (first) image is reached, the playback can be repeated in a loop.

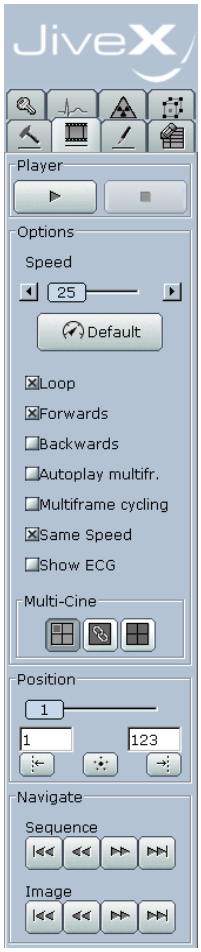


Fig. 39: "Cine" Tab

The playback is started by pressing the "Play" button. Accordingly, click on the "Stop" button to stop it.

The slider allows you to adjust the playback speed[1]. If the image data contains a default frame rate for playback, then it is used as a default value for the speed slider. You can reset the default playback speed by pressing the "Default" button.

[1] The maximum speed depends on your computer hardware.

The actual playback speed is displayed above the slider during playback. With the slider the desired value is specified; the actual speed may be lower in case of slow hardware. In this case the playback speed will be displayed in red.

The checkbox "Loop" controls whether the playback is repeated in a loop when reaching the last (first) image or if it is stopped.

The checkboxes "Forwards" resp. "Backwards" control whether the playback runs forwards or backwards. In case both of these checkboxes are selected, the playback first runs forwards once and then backwards once. Please make sure that at least one of the two checkboxes is selected.

The checkbox "Autoplay multifr.(multiframe)" controls whether multiframe images automatically start playing while navigating with the image navigation buttons on this cine tabbed pane or if multiframe images are played with the optional navigation buttons blended in on the full screen toolbar (if visible).

By selecting the checkbox "Multiframe cycling" several multiframes will be played within a series imitating one large movie sequence.

You no longer need to select single multiframes to play them individually. If normal DICOM images are included in the series (non-multiframes), then they are skipped. The checkbox "Multiframe cycling" is only enabled with focused multiframe images.

If the checkbox "Same Speed" is selected, playback speed changes apply to all multiframe images, so that they all play at the same speed. Otherwise the playback speed can be adjusted for each multiframe image separately.

The checkbox "Show ECG" shows an ECG curve (see Figure 2) included in the image data. It is played in sync with the images.

The checkbox "Show ECG" is only enabled if the image data contains ECG data (e.g. XA dataset).

It is possible to play more than one image stack at once. Within the "Multi-Cine" section, there are three options available to select images to be played:

Play focused — The default setting plays the focused image.

Play linked — Plays all linked images.

Play visible — Plays all images currently visible.

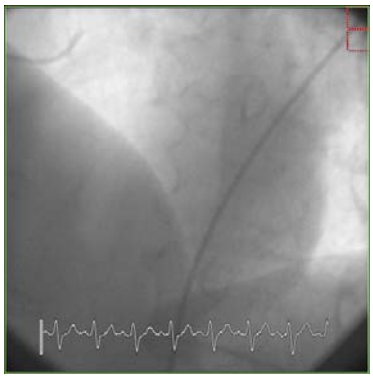


Fig. 40: ECG display

By moving the "Position" slider, you can show a certain image of the image sequence. By specifying start and end point in the input fields "Position", you can restrict the playback to a part of the series. You can, for example, skip an overview image at the beginning of the series.

You can navigate through the image stack using the buttons underneath the "Image" indicator. If a DICOM multiframe dataset has been loaded (e.g. ultrasound, cardiology), then the navigation is performed using the buttons below the "Sequence" indicator. The button functions are, from left to right, as follows: first image (frame), previous image (frame), next image (frame), last image (frame).

7.5 Image Annotations

There is a set of drawing tools for image annotations available. The tools are organized on a specific tab panel within the viewing section toolbar of the viewer.

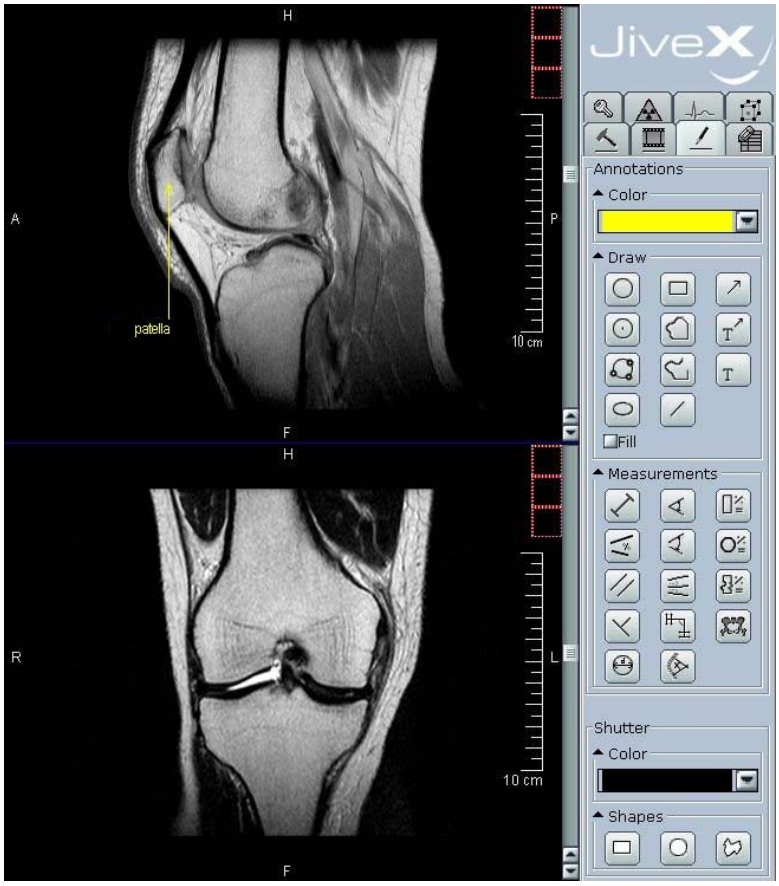


Fig. 41: Overview "Annotations"

7.5.1 Drawing Annotations

After choosing the color from the color range, please press the button of the desired graphic annotation type (Fig. 42) and click on the image to select the first coordinate (locate a point within the image). Then click on further designated coordinate(s). Alternatively, the annotation can be drawn by dragging the mouse while holding down the left mouse button.

When drawing freehand annotations, dragging with the left mouse button down will draw a freehand curve, while mouse clicks will draw polylines. A final double click finishes the annotation.

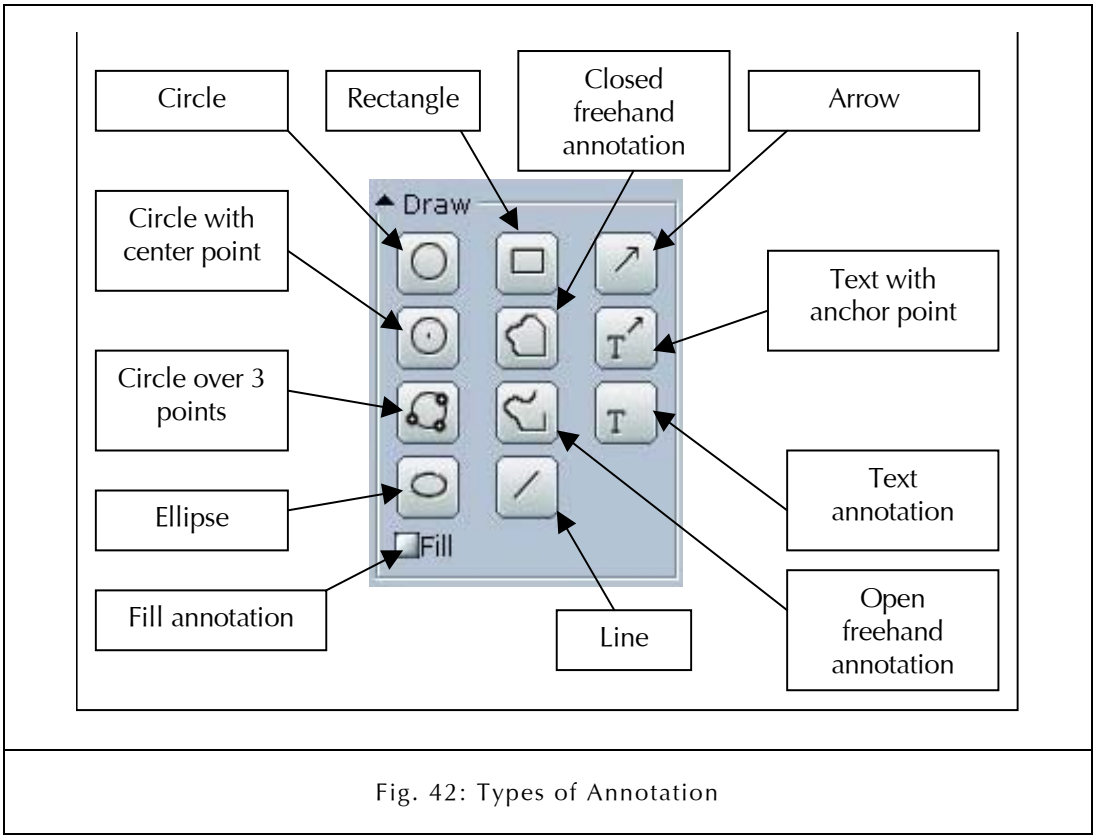


Fig. 42: Types of Annotation

A dialog box is opened when creating a textual annotation. Please enter your annotation text into the text field of this dialog box. Further characteristics like text position and color and the creation of an anchor point can be defined here.

After confirming the entry, the position of the text is determined by the first mouse click, the anchor point is set with a second click.

If you press the [C]-key while creating an annotation, the mouse cursor will be hidden to allow accurate positioning of points/lines/objects.

Drawing an annotation can be cancelled at any time by pressing the [ESC] button.

7.5.2 Manipulating Annotations

Existing annotations can be altered. For this purpose, first select the annotation by clicking inside the annotation, or on the line for line-style annotations. If several annotations exist at the same mouse position, one of them is selected initially. Further annotations can be selected by clicking at the same mouse position repeatedly until the desired annotation is selected.

You can move the selected annotation by pressing the left mouse button inside the annotation (on the line for line-style annotations) and dragging the mouse while holding down the mouse button.

You can change the size or shape of the annotation by pressing the left mouse button on a handle (small white square) of the annotation and dragging the mouse while holding down the mouse button. According to the current mouse position the mouse cursor changes its shape and indicates whether the annotation can be moved or changed by pressing the mouse button at this mouse position.

Hint: For very small annotations it can be very difficult or even impossible to move the annotation without preliminary zooming, as the handles obscure the annotation. In such a case the annotation can only be changed; moving is impossible.

Please hold down the [Ctrl]-key while dragging the annotation with the left mouse button. This will move the annotation, ignoring the handles.

If you press the [C]-key while changing or moving an annotation, the mouse cursor will be hidden to allow accurate positioning.

If an annotation has been selected, a context menu can be opened with the right mouse button. From this context menu a property dialog can be opened. The position of the annotation can be altered in relation to other annotations and it is also possible to delete the selected annotation or all annotations in the image.

The property dialog of a graphical annotation allows you to subsequently alter the annotation color. Unfilled closed annotations can be filled and vice versa. Annotation positions can also be converted from "image relative" into "display relative", which means, that they are not shifted together with the image anymore.

If you are creating textual annotations, a dialog box similar to the initial property dialog appears. Here, the text can be corrected, its position can be altered and the anchor point can be switched off. Additionally, the color can be changed and switched from "image relative" to "display relative".

For altering the order of overlapping or filled in annotations, please use the context menu to shift annotations from the screen background to the foreground.

By default, either the text of a textual annotation or its anchor point can be moved. If you press the [Ctrl]-key during the move you can move the whole textual annotation.

7.5.3 Deleting Annotations

An annotation can be deleted via its context menu. To delete all image annotations, please select "Remove All" in the context menu of any annotation of the image.

7.5.4 Calculation Functions

Within the image, distances and angles can be displayed and a statistical evaluation of the pixels (minimum, maximum, average, and standard deviation) can be

performed. Annotations are drawn in the pre-selected color and are created as explained above (see chapter *Drawing Annotations*).
The following functions are available:

Angle measurement

To calculate an angle, the three points of its two arms are marked by mouse clicks.

Open angle measurement

Furthermore there is an *Open angle measurement*: After pressing the appropriate function button, please draw two lines. Their angle of intersection is then displayed.

3-way angle measurement

For the *3-way angle measurement*, please draw three lines in succession. As a result, two angles are displayed between the three lines.

For both open angle calculations you can move the lines or the text separately from the whole annotation if you press the [Ctrl]-key during the move.

4-point angle measurement

For the *4-point angle measurement*, please draw four lines (each two lines belong together). The center points of these lines are used for a cutline calculation. The angle of both cutlines is shown.

Chiropractic pelvic bone measurement according Gonstead

This function is used for measurement of pelvic bones according to Gonstead. First, a horizontal base line is drawn from right to left femoral head with just two mouse clicks. Then, a vertical line is calculated at right angle to the base line. Please click the canter of the sacrum to fix the vertical line. The software then automatically draws lines parallel to the baseline and the vertical line while indicating the calculated values. Following this, a point is marked in the pubic symphysis, which calculates the distance to the vertical line. The lines and the dot can individually be moved and realigned. This is done by clicking and then holding the left mouse button on the desired line or point.

Diameter measurement

The diameter measurement calculates the diameter of a circle. With one click, the start point is set. By dragging or moving the mouse, a circle is drawn. With another click, the end point of the circle is set and the measured value (diameter) is shown. Also, the measurement can be activated via the keyboard with numpad-9.

Distance measurement

Distances are measured the same way as lines are drawn. Please press the measurement button und draw the distance to be displayed.

Charrière distance measurement

For this measurement, the distance is specified in the *Charrière* scale, known as French scale (FR) in the English-speaking world. *Charrière* corresponds to a third of a

millimetre (e.g., 3 fr = 1mm) and is a scale for grading sizes of sounds, tubules, catheters, and other tubular devices. This measurement is performed in the same manner as the distance measurement: Please press the measurement button and draw the distance to be displayed.

Cobb angle measurement

The Cobb angle measurement is used for evaluation of curves in scoliosis.

A line is drawn along the superior end plate of the superior end vertebra and a second line drawn along the inferior end plate of the inferior end vertebra. The angle between these two lines is measured as the Cobb angle. The starting point of a line is determined with one click; another click defines the endpoint. For the complete measurement, just four mouse clicks are needed.

Line relation measurement

The line relation measurement is used for stenosis measurement, indicating the CT-ratio. For the measurement, two lines are drawn: The starting point of the first line is fixed with a mouse click, a second click marks the endpoint of the line. The distance between the two points is displayed. Then, a third click determines the start point of the second line (line ratio); with a fourth-click the line drawing is completed.

Apart from the distance of the second display line, now the CT-ratio and the stenosis are shown.

The CT-ratio can, if both lines have the same length, reach a maximum value of "1".

The stenosis value is calculated from the deviation of the second to the first line and is given in percent.

Parallel line with distance measurement

With this function, the distance between two parallel lines is calculated. With the first mouse click, the starting point of the first line is set; she second click marks the endpoint. Following this, a third and final fourth-click determine the starting and endpoint of the second line.

Plumb line with distance measurement

The plumb line draws a vertical line at right angles to a straight line. When reading the distance of a point on the vertical line to the straight line is measured. With a first mouse click the starting point of the straight line is fixed; the second click marks the endpoint. Then the perpendicular line is fixed by a third mouse click.

Statistic measurements (rectangle)

Statistic measurements (polygon)

Statistic measurements (circle)

Statistical evaluations (*Statistic measurements*) can be calculated for three shapes (rectangle, polygon, and circle). First, one of the forms is selected and then shown in the image at the desired location. For statistical calculations, DICOM image information is used. If the image does not contain size information, the distance information is specified in pixel.

The readings are displayed in Hounsfield units (HU) as follows:

Avg	Average value
Min	Minimum value

Max	Maximum value
Std. Dev	Standard Deviation
Median	Mean value

The area of the selected range is displayed in mm^2 and pixels.

Again, you can alter the color (selected via *Properties*) as well as the position subsequently by using the context menu. Of course, a deletion of the calculations is possible at any time.

Please note:

In projection images (e.g. with the modalities CR, DX, MG and XA) the displayed objects are magnified due to physical principles. The size information in the DICOM images can relate to the imager plane or can be based upon an estimated magnification factor. For this reason, measurements on the projection images can be prone to measuring error.

7.5.5 Shutters

By using shutters, image structures outside a chosen area are blanked out with the effect that only the chosen area will be visible and displayed in a shape previously selected. The surrounded area is suppressed by color (white, grey or black) provided in a selective list which is displayed above the "Shapes" buttons.

There are three different shapes available: circles, rectangles and polygons.

Please note that, according to DICOM standards, each shape can only be used once per image. However, different types of shutters can be combined in one image.

With a second click on a shutter button the shutter type selection can be reset.

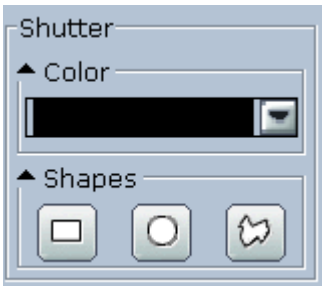


Fig. 43: Shutter

7.5.6 Presentation States

DICOM Presentation States are independent DICOM files containing information on how a particular image should be displayed (windowing values, annotations).

The advantage of using presentation states is that you can always revert back to the original image as the underlying pixel data is not modified but rather displayed differently.

Using Presentation States ensures that DICOM images are represented in the same way on different computers. Thus, a second diagnosing physician can reproduce the same image view including all visual specifications defined by a Presentation State.

With JiveX DICOM Viewer Light it is possible to read and change Presentation States, but they cannot be stored. The JiveX DICOM Viewer only allows storage of Presentation States.

The tab "Presentation States" provides a range of functions for managing loaded DICOM Presentation States. The functions are as follows:

- Order of Presentation States can be altered
- Selected Presentation States can be switched on/off
- Multiple loaded DICOM Presentation States can be switched on/off all at once
- Presentation State displayed in the viewer can be deleted
- DICOM Dump of a Presentation State is available for display
- Annotations of multiple Presentation States which include identical image data, can be merged by ticking the checkbox "Merge annots".

Loaded Presentation States indicated in the list can be enabled/disabled by a double click.

For a selected Presentation State, additional information (name of editor, description, date and time) is available.

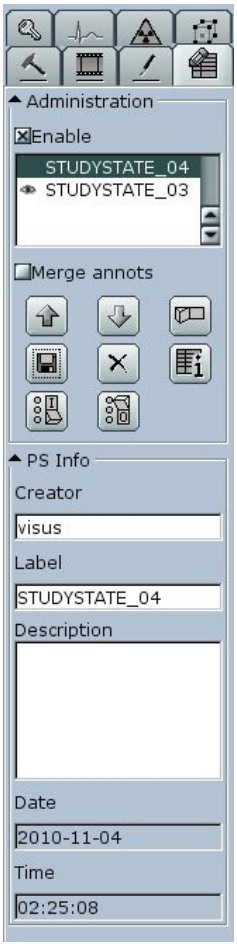


Fig. 44: "Presentation States" tab

8 DICOM Mail

To use the DICOM-Mail functionalities described below, a "JiveX DICOM Mail Viewer" licence is required. After importing the corresponding license the above described JiveX DICOM Viewer will be extended by the DICOM-Mail functionalities through an addition graphical user interface.

DICOM-Mail describes the exchange of DICOM objects using an E-Mail standard protocol based on the recommendations of the consortium of information technology[2] (@GIT) for DICOM Mail.

Based upon the "DICOM MIME Type" (see DICOM Suppl. 54 of the DICOM 3.0 Standard), this recommendation describes additional encrypting mechanisms and the use of acknowledgements. The encryption is done using the Open PGP[3] standard.

The JiveX DICOM Mail Viewer is restricted to receive DICOM Mail messages and send an acknowledgement to the sender. Furthermore, it stores the image data locally, for example on the hard drive.

The image data are managed by an inbox. It is not possible to send any kind of DICOM object using this viewer. The received DICOM objects can be exported as DICOM objects. In this way, received image data is also available to other programs.

The intended purpose of this medical device is the provision of image and diagnostic data for evaluation, distribution and quality assurance.

[2] http://www.tele-x-standard.de/

[3] RFC 2440

8.1 Inbox

The inbox shows an overview of all received DICOM mail messages. It does not list all messages individually, but combines the data contained on study level.

Using the button Inbox and Images you can change the view between the Inbox and the viewer. For displaying images from a patient CD in an image viewer, please use the button next to the [Images] button.

Receiving messages can be done automatically or on demand. This must be configured within the configuration menu. To receive a message on demand you can use the button Receive Messages. The messages will be downloaded as package. Only when a package has been completely downloaded and decoded, a refreshed list of studies is presented on the user interface.

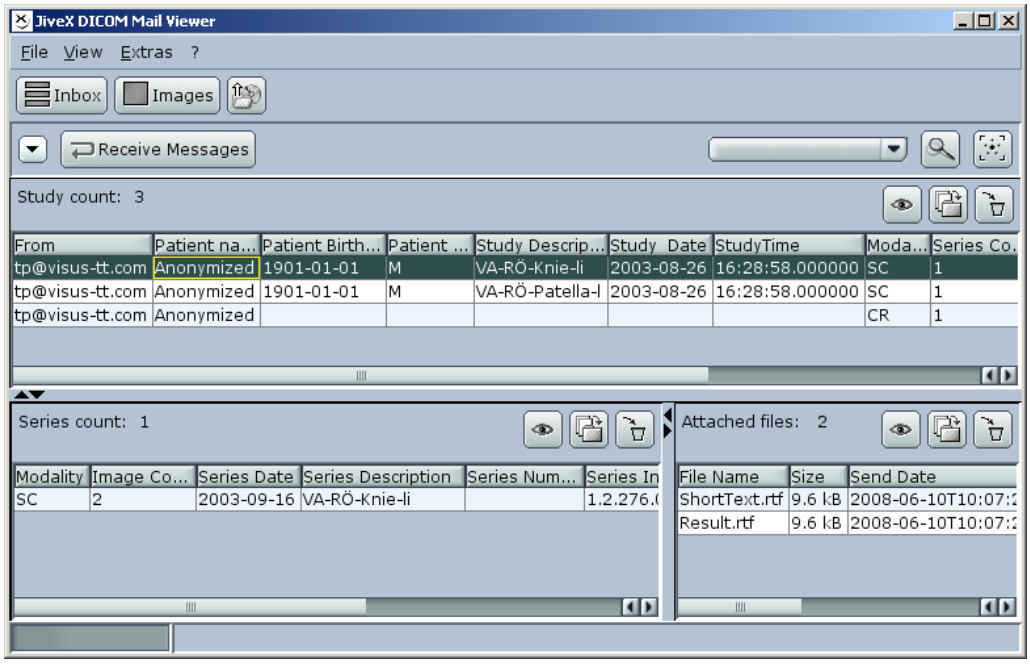


Fig. 45: Inbox

The inbox provides three tables: The table in the upper part of the program shows a list of studies. In the lower left table, the series belonging to the selected study in the table above, are indicated.

If there is any kind of none DICOM data included in the message, e.g. result text, it is presented in the lower right table.

For each of the three tables the following functions are available:

Loads the selected study or series into the viewer. For non-DICOM-compliant files displayed in the lower right part of the

program, this button opens the standard Windows® program and the viewer for the selected file.

The "Export" button allows you to save the selected study, series or non-DICOM-object to any local folder on your system. The DICOM objects remain unchanged. This function is independent of the export option provided by the "File" menu (which refers only to the currently displayed image in the image viewer).

This button is used for deleting studies, series or non DICOM objects from your hard drive forever. The deletion can not be undone.

These functions can be activated using the button or the context menu of the right mouse button.

8.1.1 Search

The entries in the study table can be filtered using various search criteria. The search is performed by pressing the button or using the [Enter] key; empty fields are ignored in the search.

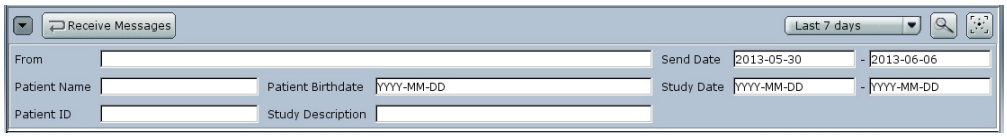


Fig. 46: Inbox filter

There are some predefined search criteria available for selection by using the button. To close or hide the search fields, please use the button in the upper left corner. In the upper right corner you can chose from a list of predefined periods. To clear all search mask fields, please press the button or the [ESC] key.

8.2 Configuration

The configuration screen can be found within the menu "Extras" -> "DICOM-Mail settings".

First, please define the folder to use for saving received emails locally. The predefined value is the "data" folder in the installation directory. Depending on your operating system and user rights, this might be adapted as the DICOM Mail Viewer user needs special read and write permissions for this directory.

For the configuration of the address book, first a network needs to be created, consisting of a group of any number of DICOM contacts amalgamated to an organizational unit. Basically, only DICOM contacts of a network can be in contact with one another. Each network is assigned to one or more mail servers.

For access to the mail server in the network, a DICOM mail account is always configured with:

- exactly one e-mail address
- the PGP certificate with private key
- exactly one network
- email account credentials (username and password)

The configuration of the address book including associated PGP certificates can be done either manually, or, in case the DICOM Mail network supports a remote configuration, this can be done remotely.

8.3 General Settings

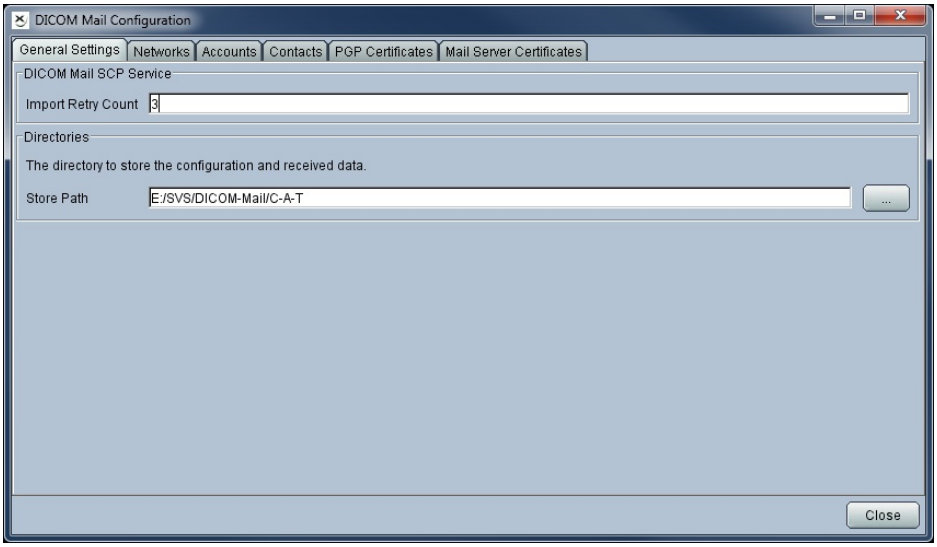


Fig. 47: DICOM Mail Configuration dialog

Using the "General Settings" tab, the basic configuration for the *DICOM Mail Service* function is performed. The following values can be configured:

- **Import Retry Count**
  Defines the number of attempts to reprocess a message in the event of error before the message will be deleted. By setting this value, the timing and insufficient memory should not cause any problems in message processing.
- **Store Path**
  Hier wird das Verzeichnis angegeben in welchem der DICOM-Mail Viewer die Konfiguration sowie alle eingehenden Daten speichert. Benutzer des DICOM-Mail Viewers benötigt Schreib- und Leserechte auf dieses Verzeichnis.

8.3.1 Network Configuration

Networks are logical units that are used to group mail servers and users. Within such a unit, only participants with DICOM contacts are able to communicate with one another. Here, the participant's contact information, email address and the PGP certificate within the network must be unique. This means, a participant is known to all network mail servers with the same email address.

When a new mail server is added to the network, it is assumed that all network participants are available via the new server. This rule applies always and without exception.

The configuration interface (Fig. 48) provides options for setting up, editing and deleting a network. However, only an unused network can be deleted.

The participants (DICOM contacts) of a network are either configured manually or via remote configuration.

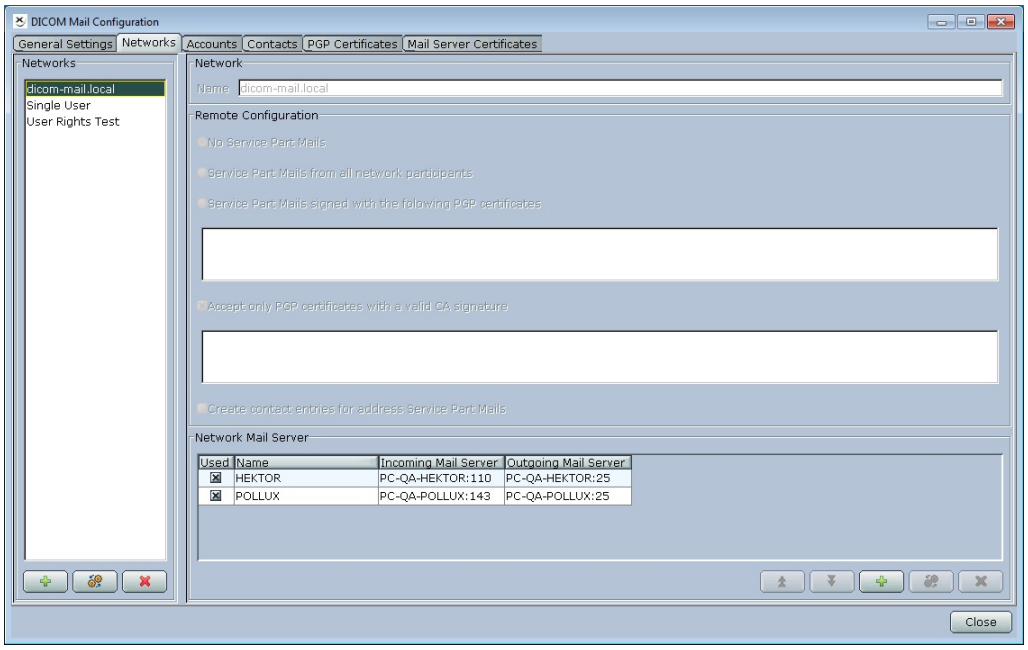


Fig. 48: Network configuration

For the "Remote Configuration" the following settings can be configured:

- **No Service Part Mails**
  Incoming configuration messages are always ignored. All participants must be created manually.
- **Service Part Mails from all network participants**
  In this scenario, change messages will be accepted by all participants in the network. At least one DICOM contact must be configured manually for this network, in order to receive change notifications.
- **Service Part Mails signed with the following PGP certificates**
  In this scenario, a list of PGP certificates must be set for the network. Change messages are accepted only if they are signed by one of the selected certificates.

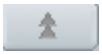
For accepting or modifying PGP certificates, it is recommended to accept only certificates that are signed by a PGP key from a trusted CA. This setting can be adjusted using the checkbox "Accept only PGP certificates with a valid CA signature". The list of CA signing certificates is defined specifically for each network.

To ensure compatibility with version 1.6, the checkbox "Create contact entries for address Service Part Mails" is used, as in the older version the "Service Part Messages" used for the configuration of contact meta data do not yet exist.

The "Network Mail Server" configuration is used to configure the mail server to retrieve DICOM Mails from and to transmit DICOM Mails to.

The sending of messages is processed in the order in which the mail servers are listed: If the first mail server is not available, then the mail will be sent via the next available mail server in the list.

Upon receipt, all mail servers are queried in sequence. The following functions are available:


Move up the selected mail server

Move down the selected mail server

Add a mail server

Edit a mail server

Delete a mail server

For a mail server, the following configurations can be made:

- **Incoming Mail Server (inbox server)**
  Name/IP address and port of the mail inbox server.
- **Mailbox type**
  Mail protocol for mail receiving (getting mails via POP3 and POP3SSL).
- **Messages per connection**
  Number of messages, that are transmitted for each connection.
- **Outgoing Mail Server (outbox server)**
  Name/IP-address and port of the outbox server.
- **Mail box type**
  Mail protocol for mail delivery; possible are: "SMTP", "SMPT/SSL" and "SMPT/TLS".
- **Authorization**
  Authentication method for SMTP; possible values are: "no", "POP before SMTP" and "SMTP auth".
- **Messages per connection**
  Number of messages, that are transmitted for each connection.
- **Maximum message size (MB)**
  Maximum size of mails to be sent. This setting allows to further restrict the maximum size of a single mail server. In combination with the global setting, the smaller of the two values is always used.
- **Send messages enabled**
  This setting defines whether this mail server is considered when sending data via the "SCU DICOM Mail Service".

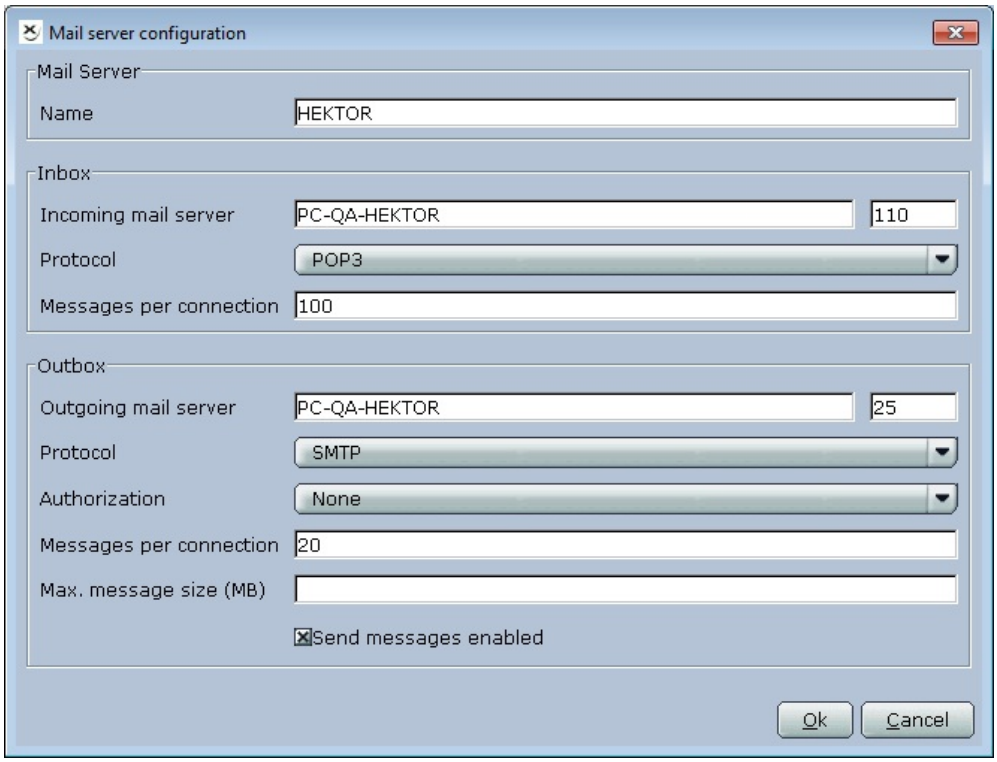


Fig. 49: Mail server configuration

8.3.2 Mail Accounts

The "Account" tab displays a table in which all configured DICOM mail accounts are listed. Here, DICOM mail accounts can be created, edited or deleted. Compared to a normal email account, a DICOM mail account defines the settings for access to an email mailbox. In addition to traditional e-mail settings (email address, username, password, delete rules), at least a PGP certificate must be specified to encrypt the communication. A DICOM mail account must always be assigned to only one network.

An account serves for the receipt of email DICOM data as well as for the dispatch of administrative data (e.g., receipts, public keys). For any existing account the DICOM Mail Viewer checks incoming new messages in a defined interval.

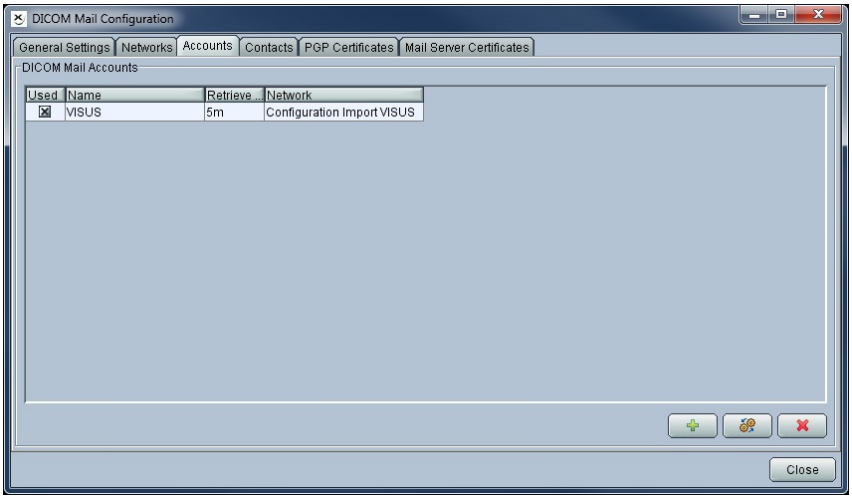


Fig. 50: "Accounts" tab

Single accounts can be managed by double-clicking on the respective list line or, alternatively, by first clicking on the list line and then pressing the [Edit] button.

An already selected account is deleted by clicking the [Delete] button. To set up a new account, please use the [New] button.

Having selected an account to configure, the dialog "Account configuration" is opened (Fig. 51).

General settings are configured on the tab with the same name.

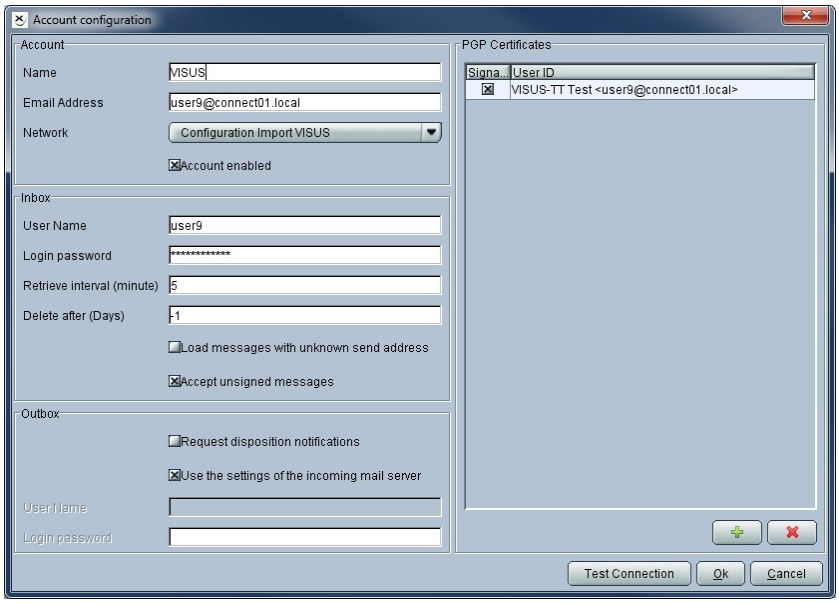


Fig. 51: General account settings

The following general account settings can be made:

- **Name**
  Participant's name of the associated account.
- **E-Mail address**
  E-Mail address of the DICOM contact. This e-mail address is unique for all configured accounts.
- **Network**
  Associated network of an account.
- **Account enabled**
  If this checkbox is activated, messages are collected for the account; with a disabled checkbox, this account will no longer be provided as the sender by the send dialog.

For the Inbox, the following settings are available:

- **User name**
  Here, the user name is specified that is used to authenticate the account to the mail server when retrieving mails.
- **Login password**
  Here, the login password is specified that is used to authenticate the account to the mail server when retrieving mails.
- **Retrieve interval (minute)**
  This specifies the time interval (given in minutes), at the end of which new messages are searched for on the mail server.
- **Delete after (Days)**
  This defines a number of days. At the end of this period, the messages will be

deleted from the server. With "0" as the given value, all messages are deleted immediately after they have been retrieved.

- **Load messages with unknown send address**
  If this checkbox is enabled, mails will be accepted from everyone, even if they are not defined in your address book. With a deactivated checkbox, all emails containing an unknown e-mail sender address will be deleted on the mail server.
- **Accept unsigned messages**
  If this checkbox is enabled, the sender will accept mails without a signature (as required for older versions of the DICOM Mail standard).

For the outgoing mail, the following settings are available:

- **Request disposition notifications**
  If this checkbox is enabled, for all outgoing emails receipt confirmations will be requested.
- **Use the settings of the incoming mail server**
  If this checkbox is enabled, the identical user name and password also used for the inbox are used for authentication with the mail server.
- **User name**
  Here, the user name is specified, which is used to authenticate the account to the mail server when sending mails.
- **Login password**
  Here, the login password is specified, which is used to authenticate the account to the mail server when sending mails.

Associating each account with a PGP certificate including a private key is mandatory for decoding the received mails that have been encrypted with the public key.

For this, it is necessary to specify one of the PGP keys as the signing certificate used to sign the outgoing DICOM mails when sending.

For PGP certificates, the following functions are provided:

Delete a certificate.

Add a certificate. This will open the "PGP certificates" dialog (see 8.3.4 Encryption) providing a list of all the saved PGP certificates to choose a certificate from.

Using the "Test connection" button will check, whether the account can access all mail servers. The result is displayed in a corresponding dialog ("Connection test").

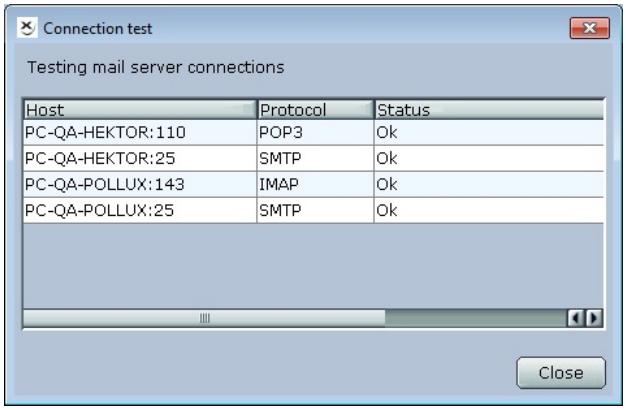


Fig. 52: "Conncection test" dialog shows the availability of mail servers

8.3.3 Address Book

Via the "Contacts" tab, the address book is maintained, i.e. contacts are created, edited and deleted here. For this purpose, the tab is divided into three areas: on the left, all contacts associated with the respective network are listed in an overview. If any of these name entries is selected via mouse click, then the details of this contact will appear on the right side within the "DICOM Mail Contact" area.

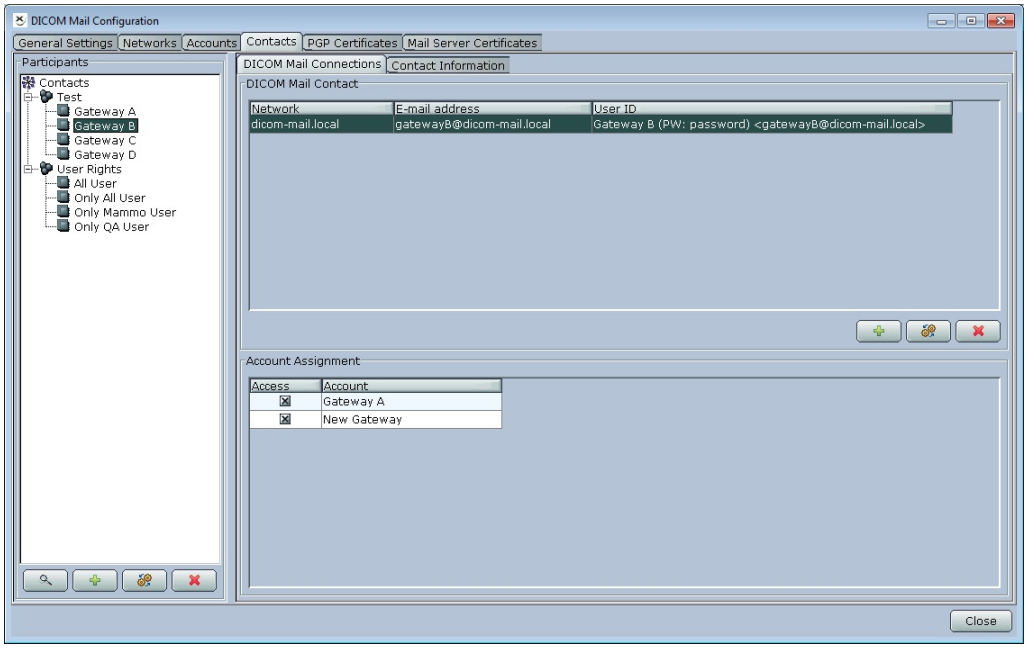


Fig. 53: Address book

A contact can be displayed with the following details:

- **Contact type** selectable options are as follows: "Organisation", "Hospital", "Department", "Person"
- **Titel** can be specified for persons
- **First name** is specified for persons
- **Name**
- **Speciality**
- **E-Mail**
- **Website**
- **Phone**
- **Mobile**
- **Fax**
- **Pager** Number of the Pager
- **Street**
- **ZIP code**
- **City** This entry can be searched for in the Clients.
- **State**
- **Country**
- **Comment** Text box for additional comments

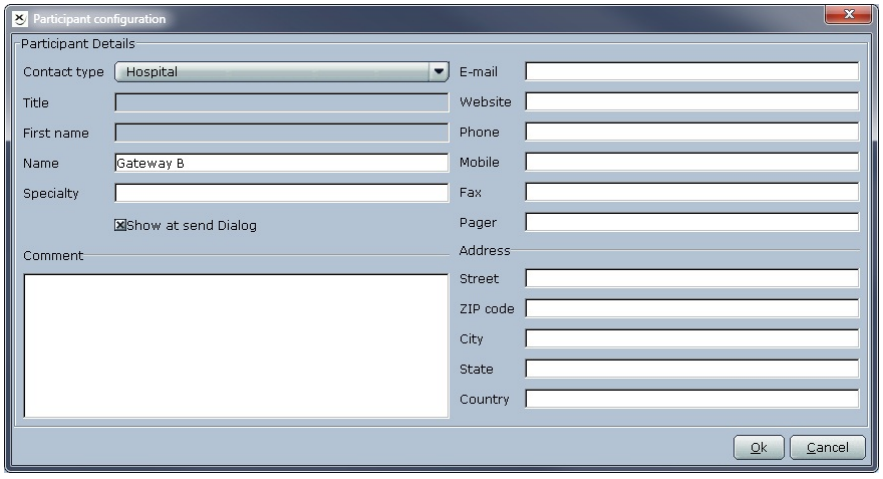


Fig. 54: Participant configuration

A participant can only be reached via DICOM Mail when having a DICOM E-Mail address. For creating, editing and deleting such an address, the following buttons are provided:

Opens the "DICOM Mail Adress" dialog that allows editing the parameters of a DICOM Mail address.

Deletes an address.

Creates a new DICOM Mail address. For this purpose, the "DICOM Mail Contact" dialog is opened. Here, the following information is entered:

- **E-mail address** (unique)
- **Encryption certificate**
  Public certificate with which the data to be transmitted can be encrypted.
- **Network**
  The DICOM Mail address should be assigned within this network. Communication with each other is enabled only for participants having addresses in the same network.

Fig. 55: Dialog "DICOM Mail Contact"

In the lower right of the "Contacts" tab, the "Account Assignment" is defined. An account can only communicate with the hereby specified network participants. This is useful when there are two accounts, which both are in the same network, but are not allowed to communicate with all participants.

8.3.4 Encryption

DICOM-Mail uses an OpenPGP compatible encryption to safeguard the transmitted data. The certificates organization and -generation can be done with every OpenPGP compatible program. For example GnuPG[4] is one of the most known open source programs. With it you can generate certificates, import them, and query key server.

Within JiveX various key lengths (2048, 3072, 4096) of PGP certificates are available for the certificate creation (previously key lengths of 1024 and 2048 were available). The PGP certificates are now generated using "RSA" algorithm (previously "DSA/ElGamal" was used).

The certificates will be saved in two files (key ring-files). One will save the private certificates (Secret Keys). The other is responsible for saving the public certificates (Public Keys). Of course, already existing key ring - files can be used. These files are stored at the "keys" folder of the JiveX Communication Server.

[4] http://www.gnupg.org/

Using the "PGP Certificates" tab allows you to manage all certificates of a JiveX Server; all known keys are listed here. For searching a certificate's user ID, a "Search" box is provided above the table.

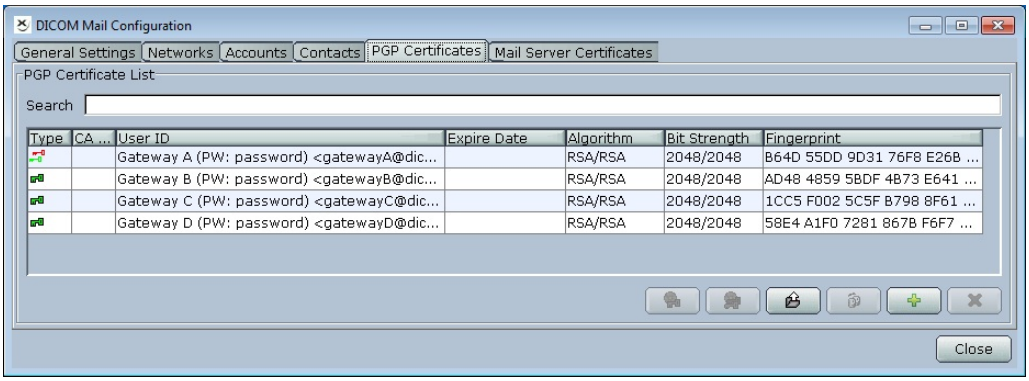


Fig. 56: PGP Certificates

The table provides the following information:

- **Key type**
  The present key type is color-coded: a private key is displayed in red, a public key is shown in green. If both keys are shown, then there is a private and a public key available.
- **CA Certificate**
  This column shows whether a certificate is used in at least one of the networks as a CA certificate. As long as this is the case, the certificate can not be deleted.
- **User ID**
  Here, the User ID of the key is displayed.
- **Expire Date**
  The key is valid until the date shown here, after which it can no longer be used. The certificate remains in use for verifying signatures of incoming messages. However, outgoing messages will no longer be encrypted with that certificate.
- **Fingerprint**
  The data of the key's fingerprint is shown here.
- **Algorithm**
  The key's algorithm is displayed here.
- **Bit Strength**
  This column shows the length of the key.

PGP Certificates are managed using the following functions:

Export the public certificate to a file.

Export the private certificate to a file.

Import the PGP Certificate.

Change the password of a private certificate.

Create a PGP certificate. This opens the dialog "New PGP certificate".

Delete a certificate.

Change Password

Using the following dialog, the password used for an PGP Certificate is changed:

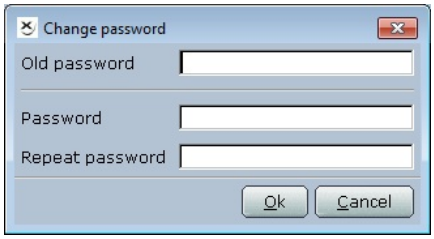


Fig. 57: Dialog for changing the password of a PGP Certificate

- **Old password**
  The current password of the certificate is entered into this input box.
- **Password**
  The newly assigned password is entered into this input box.
- **Repeat password**
  Here, the newly assigned password is entered again.

Create PGP Certificate

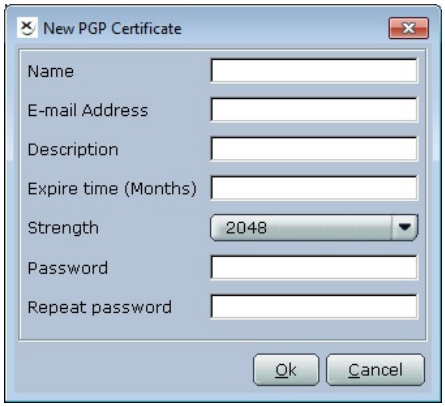


Fig. 58: Creation of a PGP Certificate

A new PGP Certificate is created with the following information:

- **Name**
  The name entered here, must contain at least five characters and is used to identify the certificate.
- **E-mail Address**
  The email address entered here is used to identify the certificate.
- **Description**
  The text entered here is used to identify the certificate.
- **Expire time / period of validity (Months)**
  The number of months for which the certificate is valid, is entered here. If no value is specified, the certificate is unlimited in time.
- **Strength**
  The key length is defined here. At least 2048 bits are required.
- **Password**
  The password you enter here will be required for access to the private part of the certificate.
- **Repeat password**
  Here, the newly registered "Password" is entered again.

8.3.5 PGP Certificate Details

A detailed display of certificate data is available by double clicking the desired certificate in the list of certificates provided by the "PGP Certificate" tab.

Fig. 59: PGP Certificate data

The following certificate data is displayed in tabular form:

- **Signature Type**
  Shows the type of signature.
- **Validation**
  Displays the status of the validation of the signature.
- **Signature User ID**
  Shows the user ID of the certificate that has created the signature. With an unknown certificate this field is blank.
- **Signature Certificate ID**
  Shows the last 16 digits of the fingerprint from the certificate that has created the signature.
- **Creation Date**
  Displays the date of the signature creation.
- **Expire Date**
  Displays the date on which, at the latest, the signature is valid.

8.3.6 Mail Server Certificates

The "Mail Server Certificates" tab is used to manage SSL-Certificates which are used for encrypted communication with the managed mail server.

If the mail server uses an unknown certificate, it will be added to this list and the connection is aborted. The certificate is marked as not trusted. In the detailed view of the certificate this needs manually to be accepted as trustworthy, after the certificate data has been checked.

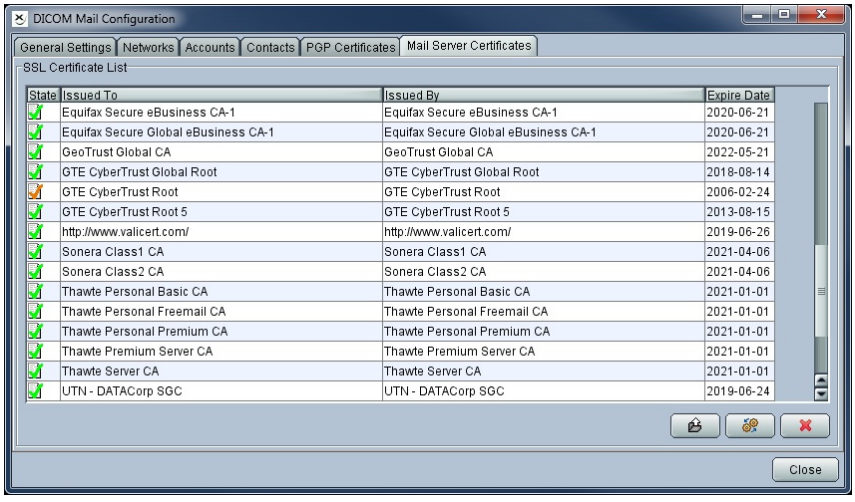


Fig.60: "Mail Server Certificates" tab

9 DICOM Calibration

It is possible to calibrate a display of monochrome images[5] according to the DICOM standard. In order to achieve a calibrated display on color monitors equipped with a standard graphic card it is necessary to access the characteristic curve of the monitor (calibration).

In the menu item "Extras" you will find the menu item "Calibration". Then, the menu item "Open calibration file" in the "File" menu enables you to select the file which contains the monitor's characteristic curve. After that JiveX corrects the screen display in order to display the calibrated monochrome images.

Also, the ambient light can be changed.

This curve can be created with the VeriLUM Software by IMAGE Smiths, Inc. (USA). The file "CC0_nc0dat" in the main directory of VeriLUM Software contains the characteristic curve which can be accessed by JiveX.

Additionally, the characteristic curve can also be imported from a text file with exactly 256 lines. Every line has to contain exactly one brightness entry (Double).

10 Image Size Calibration

The size of the images can belatedly be adjusted, if the pixel size (pixel spacing) is not included in the DICOM data set. For this purpose, you have to create a distance measurement between two points whose distance is known. Then you can choose the menu item "calibrate pixel size" of the annotation context menu (mouse right click on this distance measurement) and enter the (correct) distance.

Calibrated images will be marked with a warning symbol!

Please note:

Incorrect calibrated images will cause wrong distances and size measurements of all other annotations. Also, the area of the statistics measurements shows incorrect values!

[5] Calibration in accordance with the DICOM standard is defined only for monochrome images. There is no defined possibility to calibrate color pictures and, thus, also no defined standardized display on the screen.

11 Unlock Full Version

To unlock the full version of JiveX DICOM Viewer you have to import a license key file using the menu item "import license key" from the "?" menu. After the import, all features of JiveX DICOM Viewer are accessible.

By importing the license key file you accept the licensing conditions for JiveX DICOM Viewer and the general terms and conditions of VISUS Technology Transfer GmbH. For complete details of the imported license key file please see the "About" dialog and select the "license" tab.

For more information and updates, please visit our website (www.visus.com).

A Keyboard Shortcuts

For easier operation, there are keyboard shortcuts for most frequently used functions of the study manager.

Keyboard Shortcut	Function
[Ctrl] + 1	Switches to a 1x1 Matrix.
[Ctrl] + 2	Switches to a 2x1 Matrix.
[Ctrl] + 3	Switches to a 1x2 Matrix.
[Ctrl] + 4	Switches to a 2x2 Matrix.
[Ctrl] + 5	Switches to a 5x5 Matrix.
[Ctrl] + 6	Switches to a 2x3 Matrix.
[Ctrl] + 7	Switches to a 3x2 Matrix.
[Ctrl] + 9	Switches to a 3x3 Matrix.
[Ctrl] + P	Paper print (matrix)
[Ctrl] + [Shift] + F	Shows / hides function bar.
[Ctrl] + [Shift] + T	Shows / hides preview tree.
[Alt] + [Cursor Up]	Zooms / enlarges image.
[Alt] + [Cursor Down]	Zooms out image.
[Alt] + 1	Original size.
[Alt] + 2	Fits image to view panel size.
[F2]	Slows down Cine mode.
[F3]	Speeds up Cine mode.
[F4]	Starts and stops Cine mode.
[Alt] + W	Draws a circle annotation.
[Alt] + R	Draws a statistical circle annotation.
[Alt] + C	Displays cutlines.
[Cursor up]	Displays the previous image matrix.
[Cursor down]	Displays the next image matrix.
[Ctrl] + [Cursor up]	Displays the previous image row.
[Ctrl] + [Cursor down]	Displays the next image row.
[F5]	Displays the frame of a multiframed image.
[F6]	Displays the previous frame of a multiframed image.
[F7]	Displays the next frame of a multiframed image.
[F8]	Displays the last frame of a multiframed image.
[Del]	Deletes a selected annotation.
[Ctrl] + [Del]	Clears the focused Viewing Section.

[Ctrl] + [Shift] + [Del]	Clears all Viewing Sections.
[I]	Inverts image(s).
[G]	Views / hides user-defined annotations.
[C]	Hides the mouse cursor while creating an annotation.
[H]	Views / hides painted annotations.
[L]	Views / hides image locator.
[Q]	Equalizes the matching image planes of a study.
[V]	Browses the images' VOI LUTs.
[T]	Switches the linking for all series on or off.
[3]	Equalizes all image planes of a study of all three directions. The mouse position is used for equalization.
[Pause]	Views all images of the current series in an adapted matrix.
[Del]	Deletes a selected annotation.
[Pause]	Views all images of the current series in an adapted matrix.
[*] (num key pad)	Resets images.

To override the currently selected default left mouse button action in the image viewer, please use the following keyboard shortcuts:

Keyboard Shortcut	Function
W	Windowing
R	ROI-Zooming
Z	Zooming
P	Panning
D	Distance measurement
N	Navigates through series.
S (or N+S)	Synchronous navigation (index-based).
E (or N+E)	Synchronous navigation (distance-based).
M	Magnifies
[Ctrl] + le. mousebtn.	Moves parts of annotations (like measurements).
[Shift] + le. mousebtn.	Changes image sequence manually (drag'n'drop).
[Shift] + ri. mousebtn.	Equalize image plane on crossing a viewing section border.

The mouse buttons can be used for multiple actions:

Keyboard Shortcut	Function
Le. mousebtn	As configured, optional: pan, window, zoom, navigate.
Ri. mousebtn + mouse move	Image navigation, on multiframed images: frame navigation.

Ri. mousebtn (click)	Shows context menu.
Mouse wheel rotation	Image navigation, on multiframed images: image navigation.
Pressed mouse wheel + mouse move	Pan
Pressed mouse wheel + mouse wheel rotation	Zoom
Ri. mousebtn + mouse wheel rotation	Series navigation.
Pressed le. mousebtn + short ri. Mousebtn click	Toggle left mouse button action.

- All legal and regulatory requirements applicable to the place of installation must be taken into account by the operator!

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- **Cine**
  The image viewer's cinematic display mode
- **CS**
  JiveX Communication Server
- **cMPR**
  MPR view along a defined anatomical structure.
- **DICOM**
  Digital Imaging and Communication in Medicine - A standard for medical images
- **Folder**
  A container similar to a file folder, in which studies can be stored. Each folder has an owner and is, by default, accessible only by this owner. A folder can be made available to other JiveX users via a release mechanism.
- **Grayscale windowing**
  Alternates brightness and contrast of an image.
- **GUI**
  Graphical User Interface
- **Image Matrix**
  A viewport displays either a single image or a matrix of images.
- **Intended Purpose**
  'Intended purpose' means the use for which the device is intended according to the data supplied by the manufacturer on the labelling, in the instructions and/or in promotional materials.
- **Java**
  A platform independent programming language
- **JiveX Server**
  A server that executes JiveX Services.
- **HIS**
  Hospital Information System.
- **MPR**
  Multiplanar Reconstruction: Image reconstruction mehtod, that calculates and presents image data of the volume in the desired orientation and layer thickness.
- **Multi Site Query**
  A query performed on multiple JiveX Servers.
- **PACS**
  Picture Archiving and Communication System
- **Pictorial Index**
  The pictorial index contains all loaded images as thumbnails.
- **Profile**
  Contains customized or user specified settings.
- **ROI**
  "Region Of Interest; denotes a section of an image, which is marked by an arbitrary function, e.g. density value determination, scalpel function, annotation."

- **SCU**
  Service Class User - User of a DICOM Communication Service
- **Study Manager**
  The study manager provides functions for image searches and requests.
- **Viewport**
  The viewport is the display area for images.